GMO Labeling | Humboldt's World | Gallows Ghosts | Conspiracy Claims | New CFI CEO

Skeptical Inquirer

THE MAGAZINE FOR SCIENCE AND REASON

Vol. 40 No. 3 | May/June 2016

CREATORS OF THE PARANORMAL

JOE NICKELL

Toward a Taxonomy of Belief in the Unreal

The Gene-Editing Revolution: A SPECIAL REPORT

Scientific Reasoning at the US Air Force Academy

Belief Masquerading as Science

How *Not* to Do Science

INTRODUCTORY PRICE U.S. and Canada $5.99

0 09281 02614 3 06

Published by the Center for Inquiry in association with the Committee for Skeptical Inquiry

Committee for Skeptical Inquiry

Robyn Blumner, CEO
Barry Karr, Executive Director
Joe Nickell, Senior Research Fellow
Massimo Polidoro, Research Fellow
Benjamin Radford, Research Fellow
Richard Wiseman, Research Fellow

www.csicop.org

A PROGRAM OF THE CENTER FOR INQUIRY

Fellows

James E. Alcock*, psychologist, York Univ., Toronto
Marcia Angell, MD, former editor-in-chief, *New England Journal of Medicine*
Kimball Atwood IV, MD, physician; author; Newton, MA
Stephen Barrett, MD, psychiatrist; author; consumer advocate, Allentown, PA
Willem Betz, MD, professor of medicine, Univ. of Brussels
Irving Biederman, psychologist, Univ. of Southern CA
Susan Blackmore, visiting lecturer, Univ. of the West of England, Bristol
Sandra Blakeslee, science writer; author; *New York Times* science correspondent
Mark Boslough, physicist, Sandia National Laboratories, Albuquerque, NM
Henri Broch, physicist, Univ. of Nice, France
Jan Harold Brunvand, folklorist; professor emeritus of English, Univ. of Utah
Mario Bunge, philosopher, McGill Univ., Montreal
Robert T. Carroll, emeritus professor of philosophy, Sacramento City College; writer
Sean B. Carroll, molecular geneticist; vice president for science education, Howard Hughes Medical Institute, Madison, WI
Thomas R. Casten, energy expert; founder and chairman, Recycled Energy Development, Westmont, IL
John R. Cole, anthropologist; editor, National Center for Science Education
K.C. Cole, science writer; author; professor, Univ. of Southern California's Annenberg School of Journalism
John Cook, climate communication research fellow for the Global Change Institute at the Univ. of Queensland, Australia.
Frederick Crews, literary and cultural critic; professor emeritus of English, Univ. of CA, Berkeley
Richard Dawkins, zoologist, Oxford Univ.
Geoffrey Dean, technical editor, Perth, Australia
Cornelis de Jager, professor of astrophysics, Univ. of Utrecht, the Netherlands
Daniel C. Dennett, Austin B. Fletcher Professor of Philosophy and director of Center for Cognitive Studies, Tufts Univ.
Ann Druyan, writer and producer; CEO, Cosmos Studios, Ithaca, NY
Sanal Edamaruku, president, Indian Rationalist Association and Rationalist International
Edzard Ernst, professor, Complementary Medicine, Peninsula Medical School, Universities of Exeter and Plymouth, Exeter, UK
Kenneth Feder, professor of anthropology, Central Connecticut State Univ.
Krista Federspiel, science journalist, expert on complementary and alternative medicine, Vienna, Austria.
Barbara Forrest, professor of philosophy, SE Louisiana Univ.
Andrew Fraknoi, astronomer, Foothill College, Los Altos Hills, CA
Kendrick Frazier*, science writer; editor, Skeptical Inquirer
Christopher C. French, professor, Department of Psychology, and head of the Anomalistic Psychology Research Unit, Goldsmiths College, Univ. of London
Julia Galef, host of the Rationally Speaking podcast; cofounder, Center for Applied Rationality, Berkeley, CA
Luigi Garlaschelli, chemist, Università di Pavia (Italy); research fellow of CICAP, the Italian skeptics group
Maryanne Garry, professor, School of Psychology, Victoria Univ. of Wellington, New Zealand
Murray Gell-Mann, professor of physics, Santa Fe Institute; Nobel laureate
Thomas Gilovich, psychologist, Cornell Univ.
David H. Gorski, cancer surgeon and researcher at Barbara Ann Karmanos Cancer Institute and chief of breast surgery section, Wayne State University School of Medicine.
Wendy M. Grossman, writer; founder and first editor, *The Skeptic* magazine (UK)
Susan Haack, Cooper Senior Scholar in Arts and Sciences, professor of philosophy and professor of Law, Univ. of Miami
Harriet Hall*, MD, physician; investigator, Puyallup, WA
David J. Helfand, professor of astronomy, Columbia Univ.
Terence M. Hines, prof. of psychology, Pace Univ., Pleasantville, NY.
Douglas R. Hofstadter, professor of human understanding and cognitive science, Indiana Univ.
Gerald Holton, Mallinckrodt Professor of Physics and professor of history of science, Harvard Univ.
Ray Hyman*, psychologist, Univ. of Oregon
Stuart D. Jordan, NASA astrophysicist emeritus; science advisor to Center for Inquiry Office of Public Policy, Washington, DC
Barry Karr, executive director, Committee for Skeptical Inquiry, Amherst, New York
Lawrence M. Krauss, foundation professor, School of Earth and Space Exploration and Physics Dept.; director, Origins Initiative, Arizona State Univ.
Harry Kroto, professor of chemistry and biochemistry, Florida State Univ.; Nobel laureate
Edwin C. Krupp, astronomer; director, Griffith Observatory, Los Angeles, CA
Lawrence Kusche, science writer
Leon Lederman, emeritus director, Fermilab; Nobel laureate in physics
Stephan Lewandowsky, psychologist, School of Experimental Psychology and Cabot Institute, Univ. of Bristol, UK
Scott O. Lilienfeld*, psychologist, Emory Univ., Atlanta, GA
Lin Zixin, former editor, *Science and Technology Daily* (China)
Jere Lipps, Museum of Paleontology, Univ. of CA, Berkeley
Elizabeth Loftus*, professor of psychology, Univ. of CA, Irvine
Daniel Loxton, author, editor of *Junior Skeptic* at *Skeptic* magazine (US), artist, Vancouver, B.C., Canada
David Marks, psychologist, City Univ., London
Mario Mendez-Acosta, journalist and science writer, Mexico City
Kenneth R. Miller, professor of biology, Brown Univ.
David Morrison, space scientist, NASA Ames Research Center
Richard A. Muller, professor of physics, Univ. of CA, Berkeley
Joe Nickell, senior research fellow, CSI
Jan Willem Nienhuys, mathematician, Waalre, The Netherlands
Lee Nisbet, philosopher, Medaille College
Steven Novella*, MD, assistant professor of neurology, Yale Univ. School of Medicine
Bill Nye, science educator and television host, Nye Labs
James E. Oberg, science writer
Irmgard Oepen, professor of medicine (retired), Marburg, Germany
Paul Offit, professor of pediatrics, director of the Vaccine Education Center, the Children's Hospital of Philadelphia
Naomi Oreskes, geologist and professor, departments of the History of Science and Earth and Planetary Sciences, Harvard Univ., Cambridge, MA
Loren Pankratz, psychologist, Oregon Health Sciences Univ.
Robert L. Park, professor of physics, Univ. of Maryland
Jay M. Pasachoff, Field Memorial Professor of Astronomy and director of the Hopkins Observatory, Williams College
John Paulos, mathematician, Temple Univ.
Clifford A. Pickover, scientist, author, editor, IBM T.J. Watson Research Center.
Massimo Pigliucci, professor of philosophy, City Univ. of New York—Lehman College
Steven Pinker, cognitive scientist, Harvard Univ.
Massimo Polidoro, science writer; author; executive director of CICAP, Italy
James L. Powell, geochemist, author, professor; executive director, National Physical Science Consortium; retired college and museum president, Buellton, CA
Anthony R. Pratkanis, professor of psychology, Univ. of CA, Santa Cruz
Donald R. Prothero, paleontologist/geologist, Natural History Museum of Los Angeles County, Los Angeles, CA
Benjamin Radford, investigator; research fellow, Committee for Skeptical Inquiry
James "The Amazing" Randi, magician; CSICOP founding member; founder, James Randi Educational Foundation
Milton Rosenberg, psychologist, Univ. of Chicago
Amardeo Sarma*, chairman, GWUP, Germany
Richard Saunders, president, Australian Skeptics; educator; investigator; podcaster; Sydney, Australia
Joe Schwarcz, director, McGill Office for Science and Society
Eugenie C. Scott*, physical anthropologist; chair, advisory council , National Center for Science Education
Robert Sheaffer, science writer
Seth Shostak, senior astronomer, SETI Institute, Mountain View, CA
Simon Singh, science writer; broadcaster; UK
Dick Smith, entrepreneur, publisher, aviator, adventurer, Terrey Hills, N.S.W., Australia
Keith E. Stanovich, cognitive psychologist; professor of human development and applied psychology, Univ. of Toronto
Karen Stollznow*, linguist; skeptical investigator; writer; podcaster
Jill Cornell Tarter, astronomer, SETI Institute, Mountain View, CA
Carol Tavris, psychologist and author, Los Angeles, CA
David E. Thomas*, physicist and mathematician, Socorro, NM
Neil deGrasse Tyson, astrophysicist and director, Hayden Planetarium, New York City
Indre Viskontas, cognitive neuroscientist, tv and podcast host, and opera singer, San Francisco, CA
Stuart Vyse, psychologist, former Joanne Toor Cummings '50 professor of psychology, Connecticut College; author of *Believing in Magic: The Psychology of Superstition*
Marilyn vos Savant, *Parade* magazine contributing editor
Steven Weinberg, professor of physics and astronomy, Univ. of Texas at Austin; Nobel laureate
E.O. Wilson, Univ. professor emeritus, organismic and evolutionary biology, Harvard Univ.
Richard Wiseman, psychologist, Univ. of Hertfordshire, England
Benjamin Wolozin, professor, Department of Pharmacology, Boston Univ. School of Medicine

* Member, CSI Executive Council (Affiliations given for identification only.)

The Skeptical Inquirer (ISSN 0194-6730) is published bimonthly by the Center for Inquiry in association with the Committee for Skeptical Inquiry, P.O. Box 703, Amherst, NY 14226. Printed in U.S.A. Periodicals postage paid at Buffalo, NY, and at additional mailing offices. Subscription prices: one year (six issues), $35; two years, $60; three years, $84; single issue, $5.99. Canadian and foreign orders: Payment in U.S. funds drawn on a U.S. bank must accompany orders; please add US$10 per year for shipping. Canadian and foreign customers are encouraged to use Visa or MasterCard.

Inquiries from the media and the public about the work of the Committee should be made to Barry Karr, Executive Director, CSI, P.O. Box 703, Amherst, NY 14226-0703. Tel.: 716-636-1425. Fax: 716-636-1733. Email: bkarr@centerforinquiry.net.

Manuscripts, letters, books for review, and editorial inquiries should be sent to Kendrick Frazier, Editor, Skeptical Inquirer, EMAIL: kendrickfrazier@comcast.net. Mail: 944 Deer Drive NE, Albuquerque, NM 87122. Before submitting any manuscript, please consult our Guide for Authors for style and reference requirements and submittal instructions. It is on our website at www.csicop.org/publications/guide.

Articles, reports, reviews, and letters published in the Skeptical Inquirer represent the views and work of individual authors. Their publication does not necessarily constitute an endorsement by CSI or its members unless so stated.
Copyright ©2016 by the Center for Inquiry and the Committee for Skeptical Inquiry. All rights reserved.
Subscriptions and changes of address should be addressed to: Skeptical Inquirer, P.O. Box 703, Amherst, NY 14226-0703. Or call toll-free 1-800-634-1610 (outside the U.S. call 716-636-1425). Old address as well as new are necessary for change of subscriber's address, with six weeks advance notice. Skeptical Inquirer subscribers may not speak on behalf of CSI or the Skeptical Inquirer. Postmaster: Send changes of address to Skeptical Inquirer, P.O. Box 703, Amherst, NY 14226-0703.

Skeptical Inquirer May/June 2016 | Vol. 40, No. 3

FEATURES

32

Creators of the Paranormal

A handful of twentieth-century figures "created" the modern concept of the paranormal and its leading topics, transporting fantasy, myth, or speculation into a kind of believable "reality." Most proved to be a chimera.

JOE NICKELL

40

Dissociation and Paranormal Beliefs

Toward a Taxonomy of Belief in the Unreal

MATTHEW J. SHARPS, SCHUYLER W. LIAO, AND MEGAN R. HERRERA

45

Scientific Reasoning at the USAF Academy: An Examination into Titanium-Treated Necklaces

CRAIG A. FOSTER, CHRISTOPHER K. MCCLERNON, AND RICHARD F. REICH

51

Stick It In Your Ear! How Not To Do Science

Ear acupuncture claims to relieve sore throats. A new study seeming to support that idea is so poorly done that it provides a textbook example of how to distinguish between good and bad science.

HARRIET HALL

54

A Testament of Belief Masquerading as Science

Need there be a conflict between science and religion? Francis S. Collins thinks not, but his "evidence for belief" disintegrates under scrutiny, revealing instead a personal testament of belief.

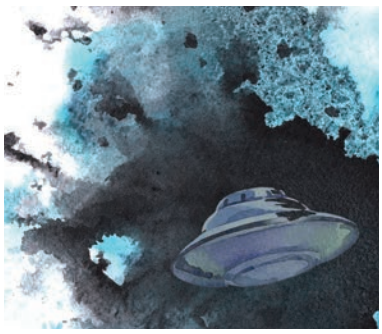
MICHAEL J. REYNOLDS

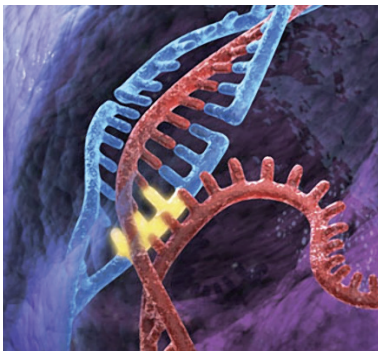
SPECIAL REPORT

24

CRISPR-Cas9: Not Just Another Scientific Revolution

KENNETH W. KRAUSE





COLUMNS

FROM THE EDITOR

Paranormal's Creators…and Some of Its Present Promoters....4

SPECIAL ANNOUNCEMENT

Center for Inquiry, Dawkins Foundation Merging; Robyn Blumner CFI's New CEO / Ronald A. Lindsay: 'A Momentous Event' / Note to SI Readers from New CEO Robyn Blumner....5

NEWS AND COMMENT

Lumosity Fined Over False 'Brain Game' Claims / Alan Alda to Receive NAS Public Welfare Medal / Scientists Urge Supreme Court: Reject Pseudoscientific Testimony for Texas Abortion Case / Italian Court Acquits Six Convicted Seismologists / Mathematical Model Debunks Conspiracies....7

INVESTIGATIVE FILES

Gallows Ghosts? Mystery at Brisbane's Tower Mill

JOE NICKELL....12

PSYCHIC VIBRATIONS

New *X-Files* Renews Cover-Up Conspiracy Claims

ROBERT SHEAFFER....14

NOTES ON A STRANGE WORLD

Theresa Caputo: The Fake Long Island Medium

MASSIMO POLIDORO....16

THE SCIENCE OF SCIENCE COMMUNICATION

Don't Fear a Franken Public

MATTHEW NISBET....18

SKEPTICAL INQUIREE

U.K. Viral 'Ghost Photo' Explained

BENJAMIN RADFORD....22

NEW AND NOTABLE....61

LETTERS TO THE EDITOR....64

THE LAST LAUGH....66

REVIEWS

The Nature of 'Nature'

PAUL BROWN....58

The Invention of Nature: Alexander von Humboldt's New World by Andrea Wulf

Hallucination or Revelation?

HARRIET HALL....60

God: An Autobiography by Jerry L. Martin

The Art and Science of the Scam: Implications for Skeptics

SCOTT O. LILIENFELD....62

The Confidence Game: Why We Fall for It…Every Time. by Maria Konnikova

Committee for Skeptical Inquiry
"... promotes scientific inquiry, critical investigation, and the use of reason in examining controversial and extraordinary claims."

[FROM THE EDITOR

The Paranormal's Creators . . . and Some of Its Present Promoters

One of the intriguing things about pseudoscience and the paranormal is that each field has been initiated and championed by just a handful of proponents and promoters. Mainly through popular books and articles (today it would be blogs, infomercials, and cable TV shows), of varying credibility and quality, they've made their impassioned appeals for the public's attention. Science has its famous heroes, but it doesn't work the same way. Collegiality and cooperation (and peer competition) mark all science, and any new scientific field quickly expands to dozens or hundreds of people working on the problems and ferreting out errors. Advocates of pseudoscience and the paranormal work more in isolation, and so those who have been successful (popularly if not scientifically) become closely identified with their "specialties."

For this issue's cover article, "Creators of the Paranormal," Joe Nickell abandons his usual case-by-case investigatory style to survey the people who created our modern concept of the paranormal and its main topics. Joe nimbly portrays such people as "unexplained collector" Charles Fort, first ghost hunter Harry Price, UFO "inventor" Raymond A. Palmer, ESP "discoverer" J.B. Rhine, cryptozoology father Bernard Heuvelmans, Bermuda "Triangulator" Vincent H. Gaddis, ancient astronaut huckster Erich von Däniken, and other famous/notorious characters. Each, he says, took a concept—a fantasy, myth, or speculation—and transformed it into a kind of "reality." Their motives varied. Some, Nickell notes, were credulous but principled. Some were out to make a buck. Others "wished to stir things up and enjoy the fray." Their creations proved popular, some enormously so, but they have turned out to be, almost without exception, scientifically barren.

That article is followed by a scholarly look at paranormal beliefs and the role subclinical psychological "dissociation" plays in their acceptance. In his third SI article on these subjects, psychology professor Matthew J. Sharps—and two colleagues—describes research showing that the tendency to believe in the paranormal is associated with a tendency toward subclinical (no, they're not crazy) dissociation. They also show that the best way to get believers to be more critical of claims about the unreal is to confront them with very specific, detail-centered questions.

Then U.S. Air Force Academy psychology professor Craig Foster and two colleagues use a classroom experiment at the Academy to test one very specific claim that might be considered paranormal: that so-called Phiten titanium-treated necklaces improve the wearer's emotional well-being. They did controlled experiments and . . . well, I'll let you read the outcome.

"SkepDoc" Harriet Hall returns to our pages with a lively look into another specific area: ear acupuncture. (Yes, really!) Hall turns her pesky knowledge and irreverent wit to demolish a new published study that found ear acupuncture useful in treating sore throats. What was wrong with the study? "Practically everything," Hall says, and she tells us why.

There's much more in this issue. I think you'll enjoy it.

—Kendrick Frazier

Skeptical Inquirer™
THE MAGAZINE FOR SCIENCE AND REASON

EDITOR Kendrick Frazier
DEPUTY EDITOR Benjamin Radford
MANAGING EDITOR Julia Lavarnway
ASSISTANT EDITOR Nicole Scott
ART DIRECTOR Christopher Fix
PRODUCTION Paul E. Loynes
WEBMASTER Matthew Licata
PUBLISHER'S REPRESENTATIVE Barry Karr

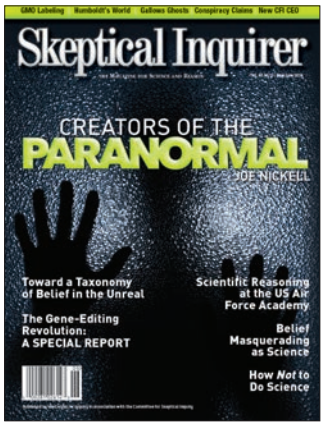
EDITORIAL BOARD James E. Alcock, Harriet Hall, Ray Hyman, Scott O. Lilienfeld, Elizabeth Loftus, Joe Nickell, Steven Novella, Amardeo Sarma, Eugenie C. Scott, Karen Stollznow, David E. Thomas, Leonard Tramiel

CONSULTING EDITORS Susan J. Blackmore, Kenneth L. Feder, Barry Karr, E.C. Krupp, Jay M. Pasachoff, Richard Wiseman

CONTRIBUTING EDITORS D.J. Grothe, Harriet Hall, Kenneth W. Krause, David Morrison, James E. Oberg, Massimo Pigliucci, Robert Sheaffer, David E. Thomas

Published in association with
CENTER FOR INQUIRY

CHAIR Edward Tabash
CHIEF EXECUTIVE OFFICER Robyn Blumner
PRESIDENT Ronald A. Lindsay
CHIEF FINANCIAL OFFICER Barry Karr
CORPORATE COUNSEL Nicholas J. Little, Brenton N. VerPloeg
BUSINESS MANAGER Patricia Beauchamp
FISCAL OFFICER Paul Paulin
SUBSCRIPTION DATA MANAGER Jacalyn Mohr
COMMUNICATIONS DIRECTOR Paul Fidalgo
DIRECTOR OF LIBRARIES Timothy S. Binga
DEVELOPMENT DIRECTOR Martina Fern
DIRECTOR, COUNCIL FOR SECULAR HUMANISM Tom Flynn
DIRECTOR, CAMPUS AND COMMUNITY PROGRAMS Debbie Goddard
DIRECTOR, AFRICAN AMERICANS FOR HUMANISM Debbie Goddard
BOARD OF DIRECTORS R. Elisabeth Cornwell, Brian Engler, Kendrick Frazier, Barry A. Kosmin, Edward Tabash (chair), Leonard Tramiel. (Honorary): Rebecca Goldstein, Susan Jacoby, Lawrence Krauss.


Skeptical Inquirer
CREATORS OF THE
PARANORMAL
JOE NICKELL
Toward a Taxonomy of Belief in the Unreal
The Gene-Editing Revolution: A SPECIAL REPORT
Scientific Reasoning at the US Air Force Academy
Belief Masquerading as Science
How Not to Do Science

A handful of twentieth-century figures "created" the modern concept of the paranormal and its leading topics, transporting fantasy, myth, or speculation into a kind of believable "reality." Most proved to be a chimera. See page 32.

Center for Inquiry, Richard Dawkins Foundation Merging; Robyn Blumner CFI's New CEO

A year-long effort to find a successor to the Center for Inquiry's outgoing president and CEO, Ronald A. Lindsay, came to a successful conclusion earlier this year with a big double-whammy announcement: the new president and CEO of CFI will be Robyn Blumner, president and CEO of the Richard Dawkins Foundation for Reason & Science (RDFRS), and the RDFRS would be merging with CFI. The new organization will be the largest secularist and skeptic organization in the United States and will bear the name Center for Inquiry, with the Richard Dawkins Foundation for Reason & Science becoming a division of CFI.

The Center for Inquiry, a nonprofit educational, advocacy, and research organization, is home to our Committee for Skeptical Inquiry and Skeptical Inquirer magazine and the Council for Secular Humanism and *Free Inquiry* magazine. Now it will also be home to the RDFRS and its programs.

Blumner became CEO of the combined entity on January 25, 2016. Lindsay retains the title of president until the merger is complete and will work closely with Blumner during the transition period.

Before heading up the RDFRS, Blumner, a lawyer, had been a syndicated columnist for the *Tampa Bay Times* and the head of statewide affiliates of the American Civil Liberties Union in Florida and Utah.

Dawkins, the noted evolutionary biologist and author, will become a member of the CFI Board of Directors, along with the two other directors of RDFRS, once the merger is complete. He has long been a fellow of the Committee for Skeptical Inquiry and a prominent advocate for good science and opponent of pseudoscience in all its forms.

The merged organization will be the largest in the United States with a mission of promoting secularism and science.

The January 21 announcement (http://www.centerforinquiry.net/newsroom/cfi_dawkins_merger/) said CFI and RDFRS planned to begin unified operations immediately, although the merger will not become final until later this spring after necessary legal and regulatory approval.

The merged organization will be the largest in the United States with a mission of promoting secularism and science, with an annual budget in excess of $6 million and a staff of about forty-five employees.

CFI will maintain its main headquarters in Amherst, New York. Both CFI and RDFRS have executive offices in Washington, D.C., and these will be combined. CFI branches in Los Angeles and other cities will be retained.

"I am absolutely delighted that I'm closing out my tenure at CFI by helping to bring about a merger between RDFRS and CFI," Lindsay said in the announcement. "Both organizations share a vital common mission, and together we can accomplish much more. And, of course, CFI looks forward to the benefit of close collaboration with Richard Dawkins, indisputably one of the preeminent public intellectuals of our time." (Also see, "Ronald A. Lindsay: 'A Momentous Event,'" next page.)

"Secularism is on the ascendency in the United States and beyond," Robyn Blumner observed. "Science has proven to be the engine of human progress. Bringing more resources and ambition to promoting these forces of reason is what this merger is about. I am thrilled to be tapped to lead this joint effort and expand on what Ron Lindsay has built." (Also see her note to SI readers, next page.)

For his part, Richard Dawkins said this:

> I am very pleased that my foundation is about to join forces with the Center for Inquiry. CFI is the biggest player in the secular/nonreligious/skeptical world, and I like to hope that RDFRS will have something to add to its already flourishing enterprise. In turn, among our projects which will benefit from a larger team of professionals are Openly Secular and the Teacher Institute for Evolutionary Science (TIES). I look forward to adding my voice to CFI's focus on promoting secular humanism and fighting the proliferation of pseudoscience. I am also especially delighted that Robyn Blumner, the present CEO of RDFRS, is to become the President and CEO of the whole organization. Ron Lindsay is truly (forgive the cliché) a hard act to follow. If anyone can do it, Robyn can.

Ronald A. Lindsay: 'A Momentous Event'

Ron Lindsay posted this blog entry on the CFI website January 21, 2016:

As you might recall, last year I announced that I would be stepping down as president and CEO of the Center for Inquiry, to make way for new leadership in 2016 [see "The Future of CFI," Skeptical Inquirer, September/October 2015]. I said then that I wanted to give the CFI board of directors ample time to find a highly qualified new chief executive. Consistent with my hopes and expectations, the board has found a talented, experienced leader for CFI.

Each organization brings unique strengths to the table, and given the similarity in their missions, these two organizations are an excellent match.

What I could not have expected, but I am delighted to share with you now, is that in finding a wonderful new CEO, CFI has also made an unprecedented move to become stronger and more effective than ever.

I am delighted to tell you today that the Richard Dawkins Foundation for Reason & Science has agreed to merge with the Center for Inquiry and that their president and CEO, Robyn Blumner, will be the new CEO of the combined organizations, which will work under the name of the Center for Inquiry.

CFI and RDFRS both seek to make the world a better place for all, religious and nonreligious alike, by untangling faith and pseudoscience from government, promoting critical thinking and skepticism, and advocating for science and reason in all areas of public life. Each organization brings unique strengths to the table, and given the similarity in their missions, these two organizations are an excellent match.

This is a momentous event not only for our organization but for the entire secular and skeptic movement. This new Center for Inquiry is now the largest freethought organization in the United States, and the combined talents, resources, and passion of CFI and RDFRS will allow the Center for Inquiry to have a greater impact than ever. We begin working together as one unified organization beginning right now.

And I can't wait for you to get to know Robyn Blumner. An extremely accomplished and deeply respected lawyer, activist, journalist, and nonprofit executive, Robyn has lifted RDFRS to new heights. There is no one better at this time to lead the Center for Inquiry. She will formally become CFI's CEO on Monday, January 25.

As for Richard Dawkins himself, CFI is thrilled to be associated with one of the preeminent public intellectuals of our time, and we're all eager to take full advantage of his wisdom, intelligence, and eloquence as perhaps the world's foremost communicator of science and secularism.

For me, I will retain the title of president of CFI for a brief period during the transition. I will do all I can to ensure that this new CFI gets off to a smooth and successful start.

Surely you will have a lot of questions, and we'll do our best to answer them. For now, you can get more information about this merger at our F.A.Q. at this link (http://www.centerforinquiry.net/pages/cfi_dawkins_faq/).

And please join me in warmly welcoming Robyn Blumner, Richard Dawkins, and all at RDFRS to the Center for Inquiry.

Note to SI Readers from New CEO Robyn Blumner

I know what you must be thinking: An atheist, ACLU-loving lawyer, and writer known for legal and ideological battles with Mormons in Utah and evangelicals in Florida, what can she know about science and skepticism?

And you would have a point.

My chosen profession and, to be frank, my skill set lean toward the humanities. But science fills me with awe. I come from a family in which science was held in the highest esteem. My dad graduated from the Bronx High School of Science, and had his love for soccer not interfered—he played semi-pro for a time—he would have gone into biology as a career. Instead, he taught public school and shared his passion for science (and soccer) with generations of students.

"I am thrilled and honored to be CEO of the Center for Inquiry, a place where evidence matters."

Even before my connection to the Richard Dawkins Foundation, I was an avid reader of Richard Dawkins's books. Like Carl Sagan, Richard is a master communicator of science to a lay audience. For me, these men provided a window into the workings of the evidence-based world.

As to the work of the Center for Inquiry, some may see skepticism and secularism as distinct and separate endeavors. I see them as overlapping and reinforcing. They derive from the same source: a willingness to put truth claims to the test. And when that happens, humanity benefits in profound and tangible ways.

I am thrilled and honored to be CEO of the Center for Inquiry, a place where evidence matters, and the truth gets puts through its paces for the good of us all. Thank you to everyone for the kind and generous welcome.

Lumosity Fined Over False 'Brain Game' Claims

Benjamin Radford

In early January the company behind Lumosity, the popular "brain training" program advertised as helping prevent cognitive impairment, "agreed to settle Federal Trade Commission (FTC) charges alleging that they deceived consumers with unfounded claims that Lumosity games can help users perform better at work and in school, and reduce or delay cognitive impairment associated with age and other serious health conditions," according to a press release from the FTC.

The company sold subscriptions to its "brain building" products and services, with options ranging from monthly ($14.95) to lifetime ($299.95) memberships. "Lumosity preyed on consumers' fears about age-related cognitive decline, suggesting their games could stave off memory loss, dementia, and even Alzheimer's disease," said Jessica Rich, director of the FTC's Bureau of Consumer Protection. "But Lumosity simply did not have the science to back up its ads." Count II of the FTC's complaint states:

> Defendants have represented, directly or indirectly, expressly or by implication, that training with the Lumosity Program reduces cognitive impairment associated with health conditions, including Turner syndrome, post-traumatic stress disorder, attention deficit hyperactivity disorder, traumatic brain injury, stroke, and side effects of chemotherapy. The representations . . . are false or were not substantiated at the time the representations were made.

The FTC also accused Lumosity of misleading consumers by "failing to disclose that some consumer testimonials featured on [its] website had been solicited through contests that promised significant prizes, including a free iPad, a lifetime Lumosity subscription, and a round-trip to San Francisco." The company was also fined $50 million but will only have to pay $2 million in redress and notify its clients of the FTC action.

"Lumosity preyed on consumers' fears about age-related cognitive decline."
—The FTC

Medical researchers have been skeptical for many years about the efficacy of "brain training" products such as those marketed under brand names including Lumosity and Brain Gym. In 2014, the Stanford Center on Longevity and the Berlin Max Planck Institute for Human Development asked leading cognitive psychologists and neuroscientists to examine evidence for the efficacy of brain games and programs. They issued a statement saying in part that "We object to the claim that brain games offer consumers a scientifically grounded avenue to reduce or reverse cognitive decline when there is no compelling scientific evidence to date that they do." The best medical research shows that simple—and free—physical exercise is the best way to maintain cognitive function throughout life and into old age.

Benjamin Radford is the deputy editor of the Skeptical Inquirer.

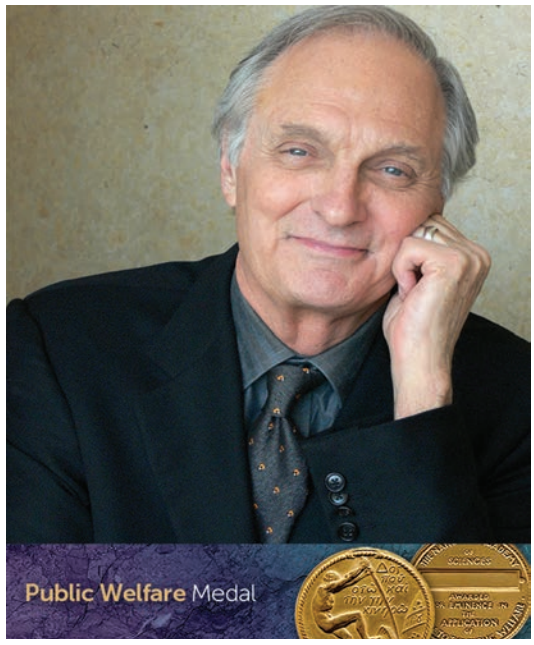
Alan Alda to Receive NAS Public Welfare Medal

Actor Alan Alda may be most famous for his character Hawkeye Pierce on the classic TV series *M*A*S*H*, but since then Alda has devoted much of his career to television programs and other forums promoting and advocating for science.

In recognition of his "extraordinary application of the skills honed as an actor to communicating science on television and stage, and by teaching scientists innovative techniques that allow them to tell their stories to the public," the National Academy of Sciences is presenting its 2016 Public Welfare Medal to Alda, whom the Academy described as an actor, director, writer, and science communicator. The medal is the Academy's most prestigious award, established in 1914 and presented annually to honor extraordinary use of science for the public good.

"Through so many different venues, Alan Alda has been a tireless advocate for science, inviting millions of people to engage in the thrills of scientific discovery," said Susan Wessler, home secretary of the Academy and chair of the selection committee for the award. "His ability to help researchers find their own voices about their work is unparalleled."

"Alan Alda is a gifted communicator, but just as impressively, he has generously shared his tal-



ents by training thousands of scientists to share their research with the public in ways that build lasting connections," said National Academy of Sciences President Ralph J. Cicerone. "We are pleased to present him our highest award."

Alda's acting career on television, film, and stage spans more than five decades. His role as science communicator is equally distinguished, noted the Academy. As host of PBS's *Scientific American Frontiers* from 1993 to 2005, Alda interviewed hundreds of researchers about new discoveries in science, technology, and medicine. He also hosted two miniseries for PBS: *The Human Spark*, which explored what makes humans unique, and *Brains on Trial*, which examined how neuroscientific data from brain mapping technology could be used as evidence to inform the court system. On Broadway, Alda appeared in *QED* as physicist Richard Feynman. He also wrote the play *Radiance: The Passion of Marie Curie* and *Dear Albert*, a reading for the stage of Einstein's letters. By the spring of 2016, *Dear Albert* will have been presented in New York City, Moscow, and Brisbane.

Alda's passion for helping scientists communicate with the public led to the establishment in 2009 of the Alan Alda Center for Communicating Science at Stony Brook University's School of Journalism, where he is also a visiting professor. Alda and the Center have trained thousands of scientists through workshops at universities and other science-oriented institutions around the country.

Alda is a member of the board for the World Science Festival and has won numerous awards, including the 2010 Kavli Science Journalism Award, the National Science Board's Public Service Award, the *Scientific American* Lifetime Achievement Award, and the American Chemical Society Award for Public Service. In 2014, he was named a fellow of the American Physical Society for his work in helping scientists improve their communication skills.

The Public Welfare Medal will be presented to Alan Alda on May 1 during the Academy's 153rd annual meeting.

Scientists Urge Supreme Court: Reject Pseudoscientific Testimony for Texas Abortion Case

Paul Fidalgo

Eminent scientists and public intellectuals are backing the Center for Inquiry (CFI) in a brief to the Supreme Court criticizing the state of Texas's onerous restrictions on abortion providers. CFI's brief argues that the alleged expert scientific testimony used to justify the restrictions is flawed pseudoscience and the Court cannot constitutionally rely on it.

In *Whole Woman's Health v. Cole,* plaintiffs argue that restrictions on abortion providers passed in Texas in 2013 impose an undue burden on women's constitutionally protected right to end a pregnancy. Since only a few clinics are able to meet the law's strictures, it will result in mass clinic closures and sharply restricted access to abortion services in the state.

The CFI brief argues that Texas's claim that the regulations protect women's health is contrary to the science and facts. As it explains, Vincent Rue, a long-discredited anti-abortion partisan with no relevant medical credentials, coordinated the testimony in support of the state's claim. Yet in every case in which Rue has coordinated testimony to defend regulations requiring abortion doctors to have hospital admitting privileges—such as those at the heart of this case—the evidence presented has been discounted by the trial court.

Federal trial courts have found that the unqualified Rue substantially ghostwrote the testimony of alleged expert witnesses in a number of cases. His efforts are agenda-driven pseudoscience that seeks to manufacture controversy, the CFI brief says.

Nicholas Little, legal director of the Center for Inquiry, said:

> This case will affect the medical well-being of millions of women, and it is unthinkable that the Supreme Court of the United States might make such a monumental decision based on such flawed testimony, that offers only misrepresentation and misdirection. While the Center for Inquiry as an organization wholeheartedly supports women's abortion rights, for this case we come to the Court purely as advocates of science and reason. Justice Kennedy, in the last abortion case to reach the Court, made clear that the Supreme Court has a duty to independently examine the facts of cases where constitutional rights are at issue. The Court has wisely rejected fabricated, pseudoscientific evidence in previous cases, and we strongly urge the justices to do the same here.

"We hope the Court is able to put abortion politics aside and focus on the illegitimacy of the medical claims propping up the restrictions," said Robyn Blumner, president and CEO of the Richard Dawkins Foundation for Reason & Science and CEO of the Center for Inquiry. "When science claims are used to infringe a constitutional right they had better be valid, but that's not the case here."

The brief argues that the state's testimony, as coordinated by Rue, "fails to demonstrate even a rational relation between the restrictions and the State's legitimate interest in women's health sufficient to overcome the burden that these restrictions create for women in Texas who are in need of essential and legally protected medical care."

The amicus brief, filed by the Center for Inquiry, was signed by the Richard Dawkins Foundation for Reason & Science, along with over forty individual scientists and experts in reason and critical thinking, including psychologist Steven Pinker, anthropologist Eugenie C. Scott, physicist Lawrence Krauss, skeptic icon James Randi, social psychologist Carol Tavris, astrophysicist Jill Tarter, and evolutionary biologist Richard Dawkins.

The complete brief can be downloaded at www.centerforinquiry.net/TexasAbortionAmicus.

The case was argued before the Supreme Court March 2, 2016.

Italian Court Acquits Six Convicted Seismologists

Benjamin Radford

In late November 2015, the Italian Supreme Court formally and finally overturned the convictions of six scientists who had been charged with manslaughter for failing to adequately warn of the dangers of an April 2009 earthquake that left 309 people dead. The seismologists had participated in a meeting a week before the earthquake to discuss the dangers of recent smaller tremors in the town of L'Aquila. The original judge had found that their risk assessment of the threat of a larger earthquake had been superficial and inadequate, resulting in townspeople being wrongly reassured that they would be safe in their homes when the earthquake struck.

The complicated case began in 2010 when the six scientists were investigated and charged, resulting in six-year prison sentences handed down in 2012; the convictions were appealed and overturned in 2014. That appeal was itself appealed by prosecutors who asked that the convictions be reinstated. This final ruling by the Supreme Court puts an end to the matter for all involved.

The five-judge panel acquitted the scientists but upheld the conviction of Bernardo De Bernardinis, at the time an official in Italy's civil protection department. The judges determined that De Bernardinis had in fact wrongly reassured the public, while the six seismic scientists had simply stated that the chance of a major earthquake remained the same and thus had neither raised undue alarm nor downplayed the risk of the quake that soon followed. De Bernardinis's jail time was reduced to two years.

The case was widely watched—and condemned—by scientists around the world concerned about being criminally charged for not accurately predicting inherently unpredictable natural disasters such as earthquakes, tsunamis, and hurricanes. The double tragedy of the earthquake and its fallout highlights the difficulty scientists have in trying to communicate absolute and relative risk to the general public.

Mathematical Model Debunks Conspiracies

Benjamin Radford

One of the hallmarks of conspiracy theories is that those involved must keep silent about it. After all, it's not much of a conspiracy if people in the know share their knowledge. But this leads to a thorny problem for believers: How could these conspiracies remain intact year after year and decade after decade? Is it plausible that the world's governments have successfully colluded over the past half-century (across multiple presidents and administrations) to hide evidence of alien contact? Is it reasonable to think that oil companies have successfully prevented the public from learning about engines that run on air or water? In this Internet age, could these secrets really remain hidden?

Many conspiracy theories claim that those involved in the cover-up have gone out of their way to announce and describe their evil plans to the world.

A new study published January 26, 2016, in the online open-access journal *PLoS ONE* (see http://tinyurl.com/z5ps7ke) examined how likely it would be that a given conspiracy of silence could be maintained over time. The study, by David Robert Grimes of the University of Oxford, notes:

> Historical examples of exposed conspiracies do exist and it may be difficult for people to differentiate between reasonable and dubious assertions. In this work, we establish a simple mathematical model for conspiracies involving multiple actors with time, which yields failure probability for any given conspiracy.

Failure, in this case, means that the conspiracy is exposed and verified for all the world to see.

Grimes examined four popular conspiracy theories (that unsafe vaccinations are being covered up; that the moon landings were faked; that Big Pharma is hiding a cure for cancer; and that climate change is a fraud), then estimated how many people would have to be involved to maintain a cover-up for each scenario, and finally calculated how long it would take for the truth to be made public—in other words, for the conspiracy to be broken. Grimes calculated that all of these conspiracies would have been revealed in less than four years. For comparison, Grimes examined three true, real-life conspiracies.

Grimes concluded:

> The analysis here predicts that even with parameter estimates favorable to conspiratorial leanings that the conspiracies analyzed tend rapidly towards collapse. Even if there was a concerted effort, the sheer number of people required for the sheer

Take action with us.

You can help promote science, reason, and secular values.

Imagine a world where religion and pseudoscience do not influence public policy—a world where religion no longer enjoys a privileged position. The Center for Inquiry is working toward these goals and educating the public to use science, reason, and secular values rather than religion and pseudoscience to establish public policy.

The Center for Inquiry advances its mission through advocacy, education, and outreach programs. No other organizations advance science and secularism on as many fronts as CFI and its affiliates, the Committee for Skeptical Inquiry, the Council for Secular Humanism, and the Richard Dawkins Foundation for Reason & Science.

Donate today.

When you make a donation to CFI, you become a member of a worldwide movement of humanists, skeptics, atheists, and freethinkers—all working together to promote the secular worldview and give voice to your values.

Our major goals include:

- Protecting the rights of nonbelievers
- Advocating for science-based medicine
- Sustaining and expanding the secular movement

Make your most generous gift today, or request information on planned giving or making a bequest.

To receive a brochure elaborating on what we are doing to achieve our important goals and how you can help, please complete and return the attached card or contact us at:

Center for Inquiry
Development Office
PO Box 741
Amherst, NY 14226
1.800.818.7071
development@centerforinquiry.net
www.centerforinquiry.net/donate

cfi CENTER FOR INQUIRY
Richard Dawkins Foundation for Reason & Science
CSI
COUNCIL FOR SECULAR HUMANISM

> scale of hypothetical scientific deceptions would inextricably undermine these nascent conspiracies. For a conspiracy of even only a few thousand actors, intrinsic failure would arise within decades. For hundreds of thousands, such failure would be assured within less than half a decade.

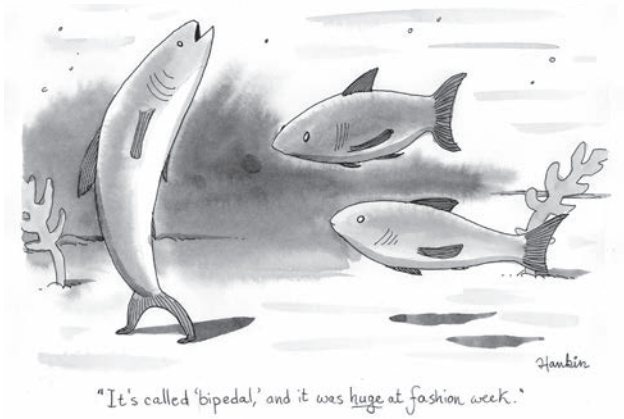
Think of all the people who would have to be involved (bribed, threatened, silenced, or even killed) to maintain a cover-up of an event on that scale. The 2012 Sandy Hook elementary school shooting—which some conspiracy theorists claim did not happen but was instead an elaborate hoax staged as a pretext to confiscate America's guns—is a good example.

As a practical matter, such an event would be essentially impossible to fake. Not only would dozens or hundreds of eyewitnesses, police officers, "crisis actors," and others be involved (and somehow silenced), but there's the (presumably) undeniable deaths of real people. If the whole thing was faked, that means that the twenty students and six teachers killed in the event never really existed—that all the employment, school, medical, and other records dating back decades were faked, along with their friends and families pretending to have known them. Conspiracy theorists believe that this scenario is somehow more plausible than the unheard-of notion that one mentally ill kid with a gun attacked the school.

Paradoxically, many conspiracy theories claim that those involved in the cover-up have gone out of their way to announce and describe their evil plans to the world. They say all the signs are there; it's all laid out in front of you, if you just understand how to interpret the clues and signs. For example, the Denver airport is the center of several conspiracy theories, ranging from some Nazi connection to being over a labyrinth of top-secret underground bunkers for the world's 1 percenters to survive a nuclear war. As evidence of these claims, believers point to murals in the airport depicting World War II–era genocide and environmental degradation, along with a message of global unity, peace, and hope. All the clues you need to understand the conspiracy are right there in the artwork—if you just know how to read the symbols.

Similarly, those involved in the alleged conspiracy to hide the fact that Paul McCartney died in the 1960s cleverly left clues in various Beatles album cover art that revealed the truth to those who knew what to look for. There were dozens of references to McCartney's demise in photos and lyrics, all cited as proof and evidence of the conspiracy. It was convincing to many people—and, of course, wrong.

Grimes's calculations confirm something known for centuries: Conspiracies are most effective when they involve a small number of people. As Benjamin Franklin sagely noted, "Three can keep a secret if two of them are dead."



There's much more available on our website!

Skeptical Inquirer

Here's just a sample of what you'll find:

Good News for Grouches: Happiness Is Overrated

Psychologist Stuary Vyse takes a closer look at the widely accepted belief that happiness is crucial to a fulfilling life: "Many of the purveyors of happiness point to research showing that happy people live longer, with the clear implication that, if you want to extend your life, you should go out and find more bliss," he writes. But is it true?

Newborn Babies Don't Have Sex, So Why Do We Vaccinate Them for a Sexually Transmitted Disease?

Harriet Hall, the "SkepDoc," examines a seemingly simple question about the need to vaccinate children: Babies don't have sex, abuse drugs, or share razors. And mothers can be tested for the Hepatitis B virus; if they don't have it, there is no risk of them transmitting it to their babies. So what are the valid reasons to vaccinate newborns?

For more online columns, features, and special content, visit **www.csicop.org.**

Joe Nickell, PhD, is CSI's senior research fellow. A former stage magician and private detective, he is author of numerous books, including *The Science of Ghosts* (2012).

Gallows Ghosts? Mystery at Brisbane's Tower Mill

According to *The Ghost Guide to Australia* (Davis 1998, 224), one or perhaps both of the ghosts of two Aborigines—convicted of murder and hanged at Tower Mill in Brisbane in 1841—may still be seen there. Residents in the neighborhood in the mid-twentieth century reported that "sometimes when they looked up at the small window facing the street they could see a faint glow and a figure inside the tower, swinging gently from side to side." No sources are given, but various online sites repeat the claims (e.g., "Tower Mill Ghost" 2016), and Tower Mill is a stop—sometimes even a point of origin—for ghost tours.

I became acquainted with the old tower (Figure 1) in October 2015 when I stayed for several days at a hotel just down the street from the historic site. (I was there to speak at the annual Australian Skeptics National Convention, October 16–18, 2015, spending some two weeks in Australia and New Zealand and conducting several investigations.) Here is my solution to the mystery of the ghosts in the tower.

Figure 1. Brisbane's historic Tower Mill is reportedly haunted. (Sketch by Joe Nickell)

Background

Tower Mill is the oldest remaining building in Brisbane. Constructed of sandstone blocks and brick in 1828, it was at that time encircled (about a third of the way up) by an exterior balcony. The tower was built as a windmill for grinding grain, especially corn. That was the main staple of the diet of convicts, who were transported from Britain to Australian penal colonies (beginning with Sydney in 1788).

The mill was outfitted with wind-powered sails, but when these proved unreliable a treadmill, powered by convicts, was installed. When the convict settlement closed in 1842, the treadmill was dismantled.

From its inception as a grist mill, the four-story structure became (at one time or another) a signal station, a fire tower, first home of the Queensland Museum, a radio-experiment site, a pioneer television broadcasting tower, and (presently) a weather observatory ("Old Windmill" 2015; Dawson 2009, 22). Once, of course, it briefly served as a gallows.

Murder

There had been conflicts between the Aborigines and British occupants of the penal colony of Moreton Bay since the 1800s. However, with the seizure of hundreds of square miles of Aboriginal land and the arrival of squatters in 1840, the native people began a coordinated response, largely involving attacks on livestock. To this powder keg, surveyors came waving firebrands. They were intruding on Aboriginal land filled with cultural sites (Dawson 2009, 4–6; Chambers 1999, 131–139).

On Sunday, May 31, 1840, members of a survey party, including a number of convicts, awoke at their bush camp some thirty kilometers south of Mount Lindesay. Surveyor Granville Stapylton—who exhibited a low regard for indigenous people—sent five convicts to clear a passage over a creek while he remained at camp with several Aboriginal men and two other convicts, William Tuck and James Dunlop (Dawson 2009, 12).

Soon three of the Aborigines left camp but returned with another, all now armed with spears. Two went to Stapylton's tent and two to Tuck's, while yet another knocked the observing Dunlop senseless with a waddy (a club). When the work party returned from the creek about noon, they found Stapylton and Tuck murdered. Abandoning the injured Dunlop, they fled back toward Brisbane. A group of thirty or so Aboriginal men meanwhile returned to the scene to strip the bodies and loot the camp. One Aboriginal man came to Dunlop's aid, and he later managed to crawl into the bush. The next evening, exhausted and hungry, he ran into a search party that had been alerted by the fleeing convicts (Dunlop 1840).

A gruesome scene awaited the searchers. Tuck's body had been stripped and partially burned, while Stapylton's was found so "torn and mangled" (possibly by the marauders' dogs) that it could not be legally identified. Three of five identified Aboriginal suspects were captured. One died before trial, but two others, named Mullan and Ningavil, faced the Sydney Supreme Court in May 1841. The prosecution focused on the murder of Tuck whose body had been identifiable, but, since it was impossible to say who struck the death blow, the accused were tried as accessories. They proclaimed their innocence, but—although

Dunlop swore they were not the attackers—other convicts claimed to have seen them in the vicinity, and they were wearing clothes stolen from the camp. They were convicted and sentenced to death (Dawson 2009, 12–20, 27).

Hanging

The tower served as an improvised gallows for the men's hanging on Saturday morning, July 3, 1841. While ghost raconteurs more than a century later would claim people had seen through a window a hanged man swinging back and forth, it seemed to me unlikely the hanging was carried out inside the tower. That it stood on a hill suggested the hanging was to be a very public display, not one hidden from view.

I investigated and found that this was indeed the case. The hanging was exterior to the tower, and a large crowd gathered, including a hundred or so Aborigines. The Foreman of Works in the Brisbane settlement, Andrew Petrie, provided a strong round beam that he extended from an upper window. The rope was hung from this beam, its noose dangling to the balcony. Possibly a trapdoor was put in the floor, or, more likely, the prisoners may have been dispatched by pushing them off the balcony (Knight 1892; Dawson 2009, 23). In any case, the drop was a short one, resulting in the condemned being slowly strangled to death. (In later executions a "long drop" was employed as a humane measure, allowing the body to fall far enough to create a force sufficient to break the person's neck.)

A ten-year-old boy who watched the gruesome event was foremen Petrie's son, Tom. A convict led him by the hand to one of the dead men's coffins where he saw the man's face. As Tom Petrie's own daughter would later write (Petrie 1904, 245), "The eyes were staring, and the open mouth had the tongue protruding from it. The horror of the ghastly sight so frightened the child that it set him crying, and he could not get over it nor forget it for long afterwards."

Hanging Specter

The dead man's features that so traumatized young Tom Petrie are consistent with a strangulation death. Such a victim will often bite his tongue (Geberth 1993, 250) that "frequently protrudes from the mouth" (Spitz 1993, 463). This confirms reports of the "short drop" of the hanging.

It also casts further doubt on the hanging-ghost story. Not only is that often-repeated tale effectively discredited by the historical error of placing the hanging inside the tower, but (and this is a more subtle point) there was no mention of the hanging ghost having grotesque features—as did at least one of the two executed Aborigines. Moreover, the description of the ghost does not give any indication that it was Aboriginal, and only a single ghost is mentioned.

Figure 2. Experimental photograph recreates a ghostly glow reported in one of the tower's windows. (Photo by Joe Nickell)

I suspect that the ghost tale—or someone's apparitional experience that inspired it—was prompted by knowledge of the fact of a hanging at the tower, while, at the same time, that knowledge was factually limited. Thus, like many other apparitional experiences that have the ghost supposedly returning "to reenact its death" (Guiley 2000, 150), the Tower Mill tale is based on a false re-creation and is therefore itself obviously false: apparently the work of some percipient's faulty imagination or the creation of a writer of fakelore.

Light in the Tower

The other element of the alleged Tower Mill apparition, we recall, is the accompanying glow—seen allegedly by unspecified eyewitnesses who had "looked up at the small window facing the street." A light-in-the-window motif is common in ghostlore.

The usual explanation for such lights is a simple illusion. While the glow or apparent light source (such as a supposed ghost lantern) does indeed appear to be located inside the structure, the source is typically not an interior one at all. Rather, as explained (with examples) in my *The Science of Ghosts*, it is a celestial or terrestrial light being reflected by the window glass (Nickell 2012, 113–114). This illusion has fooled many.

I conducted experiments at Tower Mill on two successive nights. Various effects are possible, such as the glow apparently emanating from the window in question shown in Figure 2, but are actually a reflection of a nearby light.

These experiments, along with historical research on the execution of two convicted murderers at the site, indicate that the reported ghostly phenomena at Tower Mill are part of this—and not some supernatural—world. ■

Acknowledgments

I am exceedingly grateful to John and Mary Frantz for their financial assistance, which helps make many of my investigations possible. I also thank Ross Balch, president of Brisbane Skeptic Society, for inviting me to Australia, and both Cassandra Perryman of Rainbow Beach, Queensland, and Tim Binga, CFI Libraries director, for crucial research assistance.

References

Chambers, John H. 1999. *Australia: A Traveller's History*. Gloucestershire, Great Britain: The Windrush Press.

Davis, Richard. 1998. *The Ghost Guide to Australia*. Sydney, NSW, Australia: Bantam Books.

Dawson, Christopher. 2009. *The Hanging at the Brisbane Windmill*. Fairfield Gardens, Queensland, Australia: Boggo Road Gaol Historical Society.

Dunlop, James. 1840. Deposition of June 7; cited in Dawson 2009, 13.

Geberth, Vernon J. 1993. *Practical Homicide Investigation*, 2nd ed. Boca Raton, FL: CRC Press.

Guiley, Rosemary Ellen. 2000. *The Encyclopedia of Ghosts and Spirits*, 2nd ed. New York: Checkmark Books.

Knight, J.J. 1892. In the early days–XI. *The Queenslander* (Brisbane), February 27, 402–403. Available online at http://nla.gov.au/nla.news-article19821754; accessed January 19, 2016.

Nickell, Joe. 2012. *The Science of Ghosts: Searching for Spirits of the Dead*. Amherst, NY: Prometheus Books.

The Old Windmill, Brisbane. 2015. Available online at https://en.wikipedia.org/wiki/The_Old_Windmill,_Bristane; accessed October 12, 2015.

Petrie, Constance Campbell. 1904. *Tom Petrie's reminiscences of early Queensland*. Brisbane, Australia: Watson and Ferguson. Quoted in Dawson 2009, 28.

Spitz, Werner U. 1993. *Spitz and Fisher's Medicolegal Investigation of Death*, 3rd ed. Springfield, IL: Charles C. Thomas.

Tower Mill Ghost. 2016. Available online at www.brisbanehistory.com/ghosts_of_Brisbane.html; accessed January 7, 2016.

Sheaffer's "Psychic Vibrations" column has appeared in the SKEPTICAL INQUIRER for forty years; its highlights were published as a book (Create Space, 2011). Sheaffer blogs at www.BadUFOs.com, and his website is www.debunker.com.

New *X-Files* Renews Cover-Up Conspiracy Claims

As just about everybody knows by now, the phenomenally successful TV series *The X-Files*, which ran from 1993–2002, was relaunched in 2016 with mostly the same cast and many of the same themes. In a typical episode, FBI Special Agents Dana Scully and Fox Mulder trace down tantalizing evidence of extraterrestrial or other bizarre happenings but never quite secure proof. (As if the FBI would be on the *outside* of a conspiracy involving UFOs and such, trying to find out what is happening, instead of quietly pulling strings from the inside.) The new episodes follow closely the tried-and-true conspiracy themes of the original series; people obviously have not yet had their fill of UFO and conspiracy tales.

So strong is the interest in the new series that on January 21 the CIA actually announced a special package of released documents pertaining to UFOs. The CIA Blog says:

> Take a Peek Into Our "X-Files"
>
> The CIA declassified hundreds of documents in 1978 detailing the Agency's investigations into Unidentified Flying Objects (UFOs). The documents date primarily from the late 1940s and 1950s.
>
> To help navigate the vast amount of data contained in our FOIA UFO collection, we've decided to highlight a few documents both skeptics and believers will find interesting. Below you will find five documents we think *X-Files* character Agent Fox Mulder would love to use to try and persuade others of the existence of extraterrestrial activity. We also pulled five documents we think his skeptical partner, Agent Dana Scully, could use to prove there is a scientific explanation for UFO sightings. (https://www.cia.gov/news-information/blog/2016/take-a-peek-into-our-x-files.html)

People obviously have not yet had their fill of UFO and conspiracy tales.

While it was clearly stated that these files were first released back in 1978, that fact escaped many reporters who wrote that the CIA has "just released" them. However, the fact of the announcement is being interpreted by some as highly significant. UFO author Grant Cameron wrote on the Facebook group UFO Updates:

> Obama seems to have asked for them to be highlighted in a positive light because of X-files, the same as he allowed Chase Brandon to come out with a book reviewed 8 times by the CIA security people to tell us Roswell was real and their [*sic*] were bodies which happened on the 65th anniversary of the Roswell crash. Podesta may have requested the favor.

On the other hand, many skeptics feel that this kind of pandering to conspiracy theorists is not appropriate for a government agency, especially for one with the *gravitas* of the CIA.

"Podesta" is of course John Podesta, who was Chief of Staff to President Bill Clinton and a counselor to President Obama. He is currently the chairman of Hillary Clinton's 2016 Presidential campaign. He is well known as a UFO proponent, and on February 13, 2015, Podesta tweeted, "Finally, my biggest failure of 2014: Once again not securing the #disclosure of the UFO files."

At a campaign stop in Conway, New Hampshire, on December 29, 2015, Hillary Clinton was asked about UFOs by Daymond Steer, a reporter for the *Conway Sun*. She replied, "I think we may have been (visited already). We don't know for sure."

> Clinton also said she would like to look into Area 51, a secret military base in Nevada that has long been rumored to contain aliens. At first, she called it Area 54 and then corrected herself. Hillary Clinton added that the chairman of her campaign, John Podesta, is a huge fan of UFO lore. She said he enjoys a sci-fi show on the FX network. "He has made me personally pledge we are going to get the information out," said Clinton. "One way or another. Maybe we could have, like, a task force to go to Area 51."

However, her husband, the former president, was asked about Area 51 when he appeared on the late-night

Jimmy Kimmel Show in 2014. He said, "There are no aliens there."

> Grant Cameron admits to prodding Steer to ask the UFO question of as many presidential candidates as possible. A few weeks later Steer had a chance to ask the question of Democratic candidate Bernie Sanders. Cameron wrote that Steer told him, "Bernie had no interest in the UFO question and gave me a flippant response." On the Republican side, John Kasich told Steer that he did not believe in UFOs, while Ted Cruz answered that, if elected, he might check into Area 51. Cameron noted that candidate Mike Huckabee already went on the record on the UFO question in the 2008 campaign: "I believe in G.O.D. not U.F.O." (http://goo.gl/51hmjo)

A closing note about *The X-Files*: series creator Chris Carter was the luncheon speaker at CSICOP's Twentieth Anniversary World Skeptics Conference in 1996 in Amherst, New York. It turned out to be an extremely popular event. A few months before that, Episode 20 of Season 3 of *The X-Files* aired on April 12, 1996. It took place in "Klass County." The two fake alien pilots were named "Jacques Sheaffer" and "Robert Vallee." The M.P. who later arrested them was Sgt. Hynek. I think most of our readers can figure out where those names come from!

* * *

Watch out: 2016 is claimed to be another year in which the supposed destructive planet Nibiru encounters Earth, threatening to wipe out civilization. Also known as "Planet X," it is said to come into the inner solar system every 3,600 years or so, wreaking havoc in its wake. The last time we were threatened by Nibiru was May 2003, according to a woman named Nancy Lieder who supposedly channels extraterrestrial messages from the Zetas and has acquired a lot of followers. Some people posted photos of pretty much anything in the sky and claimed it was Nibiru. When Nibiru did not show up and the predicted "pole shift" and other Earth changes did not occur, Leider promised it would be coming soon.

Conspiracy theorists are now warning us that this nonexistent object is "on a crash course with the earth." A piece by an anonymous author (whose grammar could use some improvement) on Beforeitsnews.com (February 3, 2016) warns that "NIBIRU will hit EARTH at MARCH 2016—Important NASA Employee confirms the NIBIRU existence." If this prediction is correct, then you won't be reading this, because you'll be dead.

Survivalist David Hines, also known as "Doomsday Dave," reminds us "simply surviving the Planet X flyby is key." He notes:

> What can we do to take shelter once Planet X arrives and it rains meteors? The only thing that I can suggest is, if you have a cold cellar, that would be the strongest part of your home, so you might be advised to make a shelter out of that. Those of you who live in high-rises or condominiums, I am sorry to say, you are screwed. The only suggestion is, if you have an underground parking spot, then that would offer some protection, but if your building takes a direct hit, then you stand the risk of being trapped under all the rubble, so it is a gamble, but what else can you do?
>
> Obviously, with the debris raining down from the tail of Planet X, there will be many properties that will catch fire, so what I did is purchase a couple of fire extinguishers, not expecting to put out a large house fire, but it may be enough to get you out of whatever building you reside. If I survive this apocalypse, I still have to eat, so I decided to buy a bunch of mason jars so I can pickle eggs and beets, etc.; they will last a long time. (http://goo.gl/tdndqP)

These days Nibiru is turning up in the strangest places. On December 17, 2015, astronomer and UFO skeptic James McGaha was surprised to receive an email from another astronomer asking him if he was familiar with an alleged image of Nibiru taken on an all-sky camera at Grasslands Observatory, the private observatory in southern Arizona that McGaha operates along with Dr. Tim Hunter. He was not. Many observatories, even some very small ones, operate all-sky cameras that post an image to the Internet every few minutes. (This is another reason most astronomers are so skeptical about UFO sightings: the big, detailed UFOs that people keep reporting have an amazing ability to avoid these cameras.) A YouTube video (since removed) was posted on the channel of "The Freak's Lair," purporting to show Nibiru on Grassland's all-sky camera as the sun was rising—craters and all! What was it? That big, round white spot was just a patch of frost from dew that had frozen on the dome that covers the lens. As the sun rose, "Nibiru" melted away, which was interpreted as it fading away into the daylight sky. How Nibiru could be visible only at Grasslands—and not to everybody else in the region—was not explained.

But Exopolitics guru Alfred Lambrement Webre takes a positive view of the supposed impending encounter. He suggested in 2013, "What if an upcoming flyby of Planet X/Nibiru that newly released data is suggesting will start in 2016 is in fact a catalyst for positive change, rather than a 'Destroyer'?" (http://goo.gl/pgE0GF). ■

[NOTES ON A STRANGE WORLD

MASSIMO POLIDORO

Massimo Polidoro is an investigator of the paranormal, lecturer, and cofounder and head of CICAP, the Italian skeptics group. His website is at www.massimopolidoro.com.

Theresa Caputo: The Fake Long Island Medium

Theresa Caputo, a self-proclaimed psychic whose Italian origins are quite evident (she was born Theresa Brigandi), has been a celebrity for quite some time now thanks to her reality TV show *Long Island Medium*. However, all of her apparently paranormal demonstrations are perfectly explainable and, interestingly, most of them would not have been possible only a few years ago.

Caputo, in fact, seems to be the next evolutionary step of contemporary mediums after the likes of Rosemary Altea, John Edward, Sylvia Browne, and James Van Praagh: performers who, from the stage, point to members of the audience and claim to receive communications from the dead on their behalf. In the cases of Altea, Edward, Browne, or Van Praagh, the use of old cold reading techniques is quite clear. These are techniques that undoubtedly require a quick mind, ready to grasp any information coming from the sitter and convincingly sell it back to believers as if it came from the spirits.

Caputo, however, has taken a step forward. Instead of taking risks with straight cold reading—guessing and inevitably making mistakes—she prefers to come well prepared to her shows.

To begin with, Caputo places in

the front rows those who she already knows, for whom she already has performed in the past and about whom she has already learned everything there is to know. But her great idea (or perhaps that of her staff) was to take full advantage of what modernity has to offer. In particular, it is thanks to the information found on Facebook and other social media that she can astound her public.

Thanks to an exposé by magician and skeptical investigator Mark Edward (2012), who worked on a "sting operation" on Caputo for *Inside Edition*, her methods are now quite clear. "In combination with selling seats through Ticketmaster and the use of credit cards, Facebook, Foursquare, Twitter and all the rest of the latest places people post private information, our own egocentric fascination with ourselves makes it easy for the techie-smart agent or producer to make seeming miracles happen," explains Edward. "Like the old days when the gypsy only needed to tell her sitters what they wanted to hear about themselves, we are now in an era when anyone can tell you more about yourself than you might ever want to know."

Edward relates several such episodes, revealing how absurd this can get: "At one point Theresa asked a woman, '. . . Why am I picking up baby clothes?' To which the woman replied, 'Oh, that's weird. I just put up a bunch of pictures of baby clothes on my Facebook page!' Not weird at all, really."

It is enough for her to have a few similar bits of information placed beforehand on a seating chart of the show. Her staff can then cue her to the right spots, since all seats are numbered and far apart. She really can't miss. Even the casual encounters that she seems to have on the street during her "reality" program are carefully choreographed. "In classic mentalist style," continues Edward, "everyone must sign a pre-show waiver or agreement to have their image used on television. It's only a standard form to those folks. Why would they suspect anything? They should. All the staff needs is a laptop, a name, an address and a willing victim."

Converting the 'Skeptics'

Karen Stollznow, a linguist, author, and skeptical investigator, wrote about Caputo's exaggerated displays of emotion:

> There is rarely a scene where she isn't in tears or claiming empathetic abilities, such as, "I could feel your tears running down my cheek." In one episode she announces that the spirit of a deceased six-year-old boy has become "attached" to her. Convinced that the only way to free the spirit is to meet with his mother, she tracks down the woman whose details she happens to have in an appointment book. Caputo appears to be greatly distraught by the little boy's constant presence, but she is strangely unavailable for a session until the following week. She spent this week in apparent spiritual agony, yet still had time to have lunch with friends, all the while complaining about her invisible friend. (Stollznow 2012)

Another of her specialties is confronting and converting "skeptics." As Stollznow notes:

> During a live interview for Long Island radio station KJOY a line of eight "skeptics" are pitted against her. Visibly stressed at first she asks the group, "Who lost a sister?" A woman acknowledges this question, and the medium quickly finds her stride, achieving perceived "hits" with her staple "validations" about clothing and personal letters. Caputo had emotionally disarmed the woman who was taken in by what a real skeptic would readily recognize as a classic cold reading. Skillful editing seems to have ironed out any misses and genuine skeptics.

It is no surprise, then, that in 2012 Theresa Caputo received a *Pigasus Award for Performance* from the James Randi Educational Foundation.

Today mediums really have an easy life. One wonders what Margery Crandon, D.D. Home, Eusapia Palladino, and all of the famous mediums of the past would have given for a chance to amaze their clients in such an easy way, instead of risking every night to be proven wrong by tipping tables with their legs or exuding ectoplasm gauze. It all seems very silly, in the end, but it is quite distressing to look at the effect that banalities of this kind can have on the grieving. People get emotional; they start to cry and seem to be willing to give Caputo everything they have in order to speak again with their loved ones. Instead of helping the grieving accept their loss and go on with life, such "performers" keep them stuck in their sad situation, preventing their healing. The only consolation is that she won't last long, as this is the fate that awaits all self-styled psychics. "Caputo," admonishes James Randi, "is just one more of the myriad faux seers who have stepped into the TV spotlight for their turn, and though her exuberant shtick rather outdoes the others, she'll do her number along with Van Praagh, John Edward and 'Psychic Sally' until someone with a newer novelty elbows her offstage" (Randi 2012). ■

Caputo's great idea was to take full advantage of what modernity has to offer. In particular, it is thanks to the information found on Facebook and other social media that she can astound her public.

References

Edward, Mark. 2012. Is Caputo kaputo yet? *Skepticblog* (November 9).

Stollznow, Karen. 2012. Long Island medium: A tall story. *JREF Swift Blog* (June 27).

Randi, James. 2012. The "medium" is not the messenger. *Wired* (September 4).

Matthew Nisbet is associate professor of communication at Northeastern University and a Committee for Skeptical Inquiry scientific consultant. From 1997 to 1999, he was public relations director for CSI.

Don't Fear a Franken Public

The Surprising Reasons Why We Should Label Genetically Modified Food

In January 2016, Campbell Soup generated headlines by announcing that it would voluntarily label its products containing genetically modified (GM) corn, soy, beets, and other crops. Like most food industry leaders, about three quarters of Campbell Soup products contain such ingredients.

The company's announcement came in advance of a summer deadline set by Vermont requiring the labeling of GM foods sold in the state. Legislatures in more than twenty states have considered similar requirements. Food industry groups have lobbied for congressional legislation preempting any state requirements, encouraging voluntary disclosure. But Campbell Soup is notable for breaking with this strategy, calling instead for mandatory labeling (Strom 2016).

Contrary to the claims of "Frankenfood" opponents, research shows that Americans have not turned against the promising technology. Most remain unaware of the debate. If asked directly, Americans voice support for labeling, but these opinions are neither deeply held nor top of mind.

In this context, Campbell Soup's strategy is a shrewd gamble that could lead to several counterintuitive yet welcome outcomes. If Americans were to encounter GM labels on almost all processed foods, the ubiquity and apparent safety of such foods may actually bolster public trust and confidence, quelling controversy and opening the door to a next generation of GM food products that offer enormous benefits.

Science vs. Movement Politics

According to the U.S. Food and Drug Administration and other expert organizations, GM foods in comparison to other food products do not pose substantial risks to human health. Thus, federal regulators, experts, and industry members argue that there is no scientific or legal justification for special labeling.

Yet a few discredited studies provide just enough rhetorical fodder for activists to falsely claim that the technology poses a health threat. In the face of such

uncertainty, they argue that precaution should be the rule. Therefore, consumers have a "right to know" if they are consuming GM ingredients.

For these activists, the debate over the scientific justification for labeling is a smokescreen that clouds deeper-rooted grievances. In this sense, no amount of scientific evidence will soften their opposition. The origin of these grievances can be traced to the rise of America's local food movement.

During the early 2000s, looking across survey findings, researchers concluded that most Americans were unaware of GM food products, lacked basic knowledge of the science or policy specifics involved, and had yet to form strong opinions about the issue (Shanahan et al. 2001).

But among a smaller segment of consumers, the issue was emerging as a chief concern, correlated with a cluster of other food-related attitudes. Those few Americans who said they actively looked to buy GM-free food also said that they preferred their food to be organic, vegetarian, natural, locally produced, not processed, and without artificial colors or flavors (Bellows et al. 2010).

These consumers were early adopters of many of the beliefs and preferences that constitute today's local food movement. The origins of the movement date back to the 1980s and a series of food safety controversies. Since then influential activists, food writers, and documentary filmmakers have argued the connections between industrial food production, agricultural policy, and problems such as obesity, income inequality, food-borne illness, and the decline of community life (Pollan 2010). In doing so, they have contributed to a new food politics, helping a diversity of groups unify behind a movement pushing for food system reforms.

From Portland, Maine, to Portland, Oregon, many regions have rebuilt their economies and identities around locally owned, mostly organic farms, restaurants, and artisanal foods. These local efforts are complemented by the popularity of well-known national organic brands such as Stonyfield Farms and Horizon. In 2014, U.S. consumption of organic fruits, vegetables, dairy, breads, meat, and other foods generated an estimated $35 billion in sales, more than triple the amount from a decade ago (USDA n.d.).

The growth in the organics industry and local food economies has created a formidable alliance of farmers, entrepreneurs, and activists who bring considerable money, influence, and voice to the debate over labeling. For this alliance, corporate controlled, "unnaturally" produced GM food is perceived as a direct threat to their livelihood and preferred way of life.

Simmering at the grassroots level for years, in 2012 the labeling of GM food exploded into prominence as a hotly debated political issue.

Labeling: Not a Big Deal?

Simmering at the grassroots level for years, in 2012 the labeling of GM food exploded into prominence as a hotly debated political issue. In successive years, California, Washington, Oregon, and Colorado residents considered and eventually voted down proposals to label GM food products. In these battles, the food industry is estimated to have spent more than $100 million to block labeling efforts, while activists and organic industry members spent tens of millions promoting the measures.

These battles across Western states generated considerable national media coverage. Yet despite the attention, carefully designed survey research suggests that broader public awareness remains remarkably low. For at least a decade, the great majority of processed foods sold in grocery stores have contained ingredients from GM crops. But when asked in a 2013 Rutgers University survey about the matter, only 44 percent of Americans said they were aware of such foods, and only 26 percent believed that they had ever eaten any food with GM ingredients (Hallman et al. 2013).

A majority of Americans in 2013 said they know very little or nothing at all about GM foods, and 25 percent said they had never heard of them. Even among those who answered they were aware of the issue, a majority mistakenly believed that GM tomatoes, wheat, and chicken products were being sold in supermarkets (Hallman et al. 2013). Specific to labeling, if asked directly, 80 percent of the public said that it was either "very important" or "somewhat important" to know whether a product contains GM food. Yet these labeling preferences are weakly held. In the 2013 Rutgers survey, when respondents were asked in an unprompted way "What information

would you like to see on food labels that is not already on there?" only 7 percent said GM food labeling. Moreover, only one in four Americans knew that federal regulations do not currently require such labels (Hallman et al. 2013).

Given the public's ambivalence about labeling, economists have long questioned claims that labeling would deter the great majority of consumers from purchasing GM food products. For most Americans, cost and brand preference rather than labeling drives their food choices. To the extent that most organic foods today cost 50 to 100 percent more than their GM counterparts, this price difference is likely to override any impact of labels.

To test these assumptions, economists Marco Costanigro and Jayson Lusk designed a series of experiments that asked a sample of American adults to choose among apples and Cheerios that were either labeled as genetically modified or were unlabeled. To simulate the price differences for these products, those marked as genetically modified were priced at half the cost of their unlabeled counterparts. Across conditions, the economists did not observe any significant impact of labeling on risk perceptions or concern. Subjects rated GM apples and Cheerios just as safe as their non-modified counterparts. The economists, however, did find that a GM label made consumers somewhat more willing to pay a premium for unlabeled apples and Cheerios. In other words, though GM labels are unlikely to raise undue alarm among consumers, such labels may indirectly help boost sales of organic food products (Costanigro and Lusk 2014).

Citing this research and other evidence that labels are not likely to scare the public, some experts have argued that if the food industry were to follow the lead of Campbell Soup and support a mandatory labeling law, the strategy would help to restore public trust in the food industry while defusing controversy. "People are getting increasingly scared of [GM food] precisely because the industry is fighting a rearguard battle not to tell people which foodstuffs contain them," argues author and writer Mark Lynas (2013). "This has to be the worst PR strategy ever: can you think of a single analogy where an industry uses every media tool, every electoral and legal avenue possible to stop people knowing where their own products are used?" As David Ropeik (2013), a risk communication consultant, argued in an open letter to the food industry:

> Even if you win the vote, you will lose the war . . . because the war isn't about labeling. It's about the public's lack of trust in you, and therefore their opposition to the technology that is so important to your success. Your company's opposition to labeling is hurting you far more than it's helping. It is time for a new approach.

To continue to battle against labeling rules is also risky business, lending credibility to claims by activists that the industry has an undue, corrupting influence on the political process.

Defusing Controversy

Certainly if the food industry were to support mandatory GM labeling, the precise impact on consumers remains unkown. But to continue to battle against labeling rules is also risky business, lending credibility to claims by activists that the industry has an undue, corrupting influence on the political process. In contrast, the labeling of GM food may have only a limited impact on consumer buying habits, while doing little to alarm the public about the safety of the technology. Putting an end to the labeling controversy is also likely

to benefit public debate over the next generation of genetically engineered foods, ensuring that scientists, universities, and companies have the freedom to pursue breakthrough technologies.

These innovations are aimed directly at helping the world meet a 70 percent increase in food demand by 2050. Some crops have been engineered to counter deficiencies in vitamin A and iron among populations in developing countries. Other GM crops are able to survive under conditions of drought, extreme heat, or unfavorable soil conditions (Wohlers 2013). After many years of evaluation, in 2015 a genetically engineered salmon became the first modified animal approved for human consumption by the U.S. government. The small company that pioneered the high-tech salmon says that they can be grown in half the time and using 25 percent less small wild fish as feed. The system recycles 95 percent of the water used and reduces harmful waste. The all-female sterile fish are raised in landlocked tanks, making escape into the wild unlikely. Currently produced in Panama, the plan is for the fish to be grown close to large U.S. urban areas, reducing the energy costs associated with transportation (Saletan 2015).

Activists have moved quickly to oppose such "Frankenfish," pressuring major grocery store chains and restaurants to refuse to sell the sustainability-friendly product. Apart from unsupported claims about environmental and health risks, their chief complaint is that the fish would not be labeled. As the case of engineered salmon suggests, as important high-tech crops and farming practices are brought to market in coming years, the chief strategy of GM food opponents to appeal to the public's "right to know" can be removed from the table by pushing for a smart, mandatory labeling policy. ■

References

Bellows, A.C., G. Alcaraz, and W.K. Hallman. 2010. Gender and food, a study of attitudes in the USA towards organic, local, US grown, and GM-free foods. *Appetite* 55(3): 540–550.

Costanigro, M., and J.L. Lusk. 2014. The signaling effect of mandatory labels on genetically engineered food. *Food Policy* 49: 259–267.

Hallman, W.K., C.L. Cuite, and X.K. Morin. 2013. Public perceptions of labeling genetically modified foods. Working Paper 2013-01. Rutgers University. Available online at http://sebsn-jaesnews.rutgers.edu/wp-content/uploads/2014/06/RU-GM-labelingperception-white-paper-2013.pdf.

Lynas, M. 2013. It's time to label GMOs: Why we need to move biotech out of the shadows. The Breakthrough.org (October 23). Available online at http://thebreakthrough.org/index.php/programs/conservation-and-development/its-time-to-label-gmos.

Pollan, M. 2010. The food movement, rising. *New York Review of Books* (June). Available online at http://www.nybooks.com/articles/2010/06/10/food-movement-rising/.

Ropeik, D. 2013. GMO labeling: An open letter to BigAgTech CEOs. *The Huffington Post* (November 6). Available online at http://www.huffingtonpost.com/david-ropeik/gmo-labeling_b_4224023.html.

Saletan, W. 2015. Don't fear the Frankenfish. Slate.com (November 20). Available online at http://www.slate.com/articles/health_and_science/science/2015/11/genetically_engineered_aquabounty_salmon_safe_fda_decides.html.

Shanahan, J., D. Scheufele, and E. Lee. 2001. Trends: Attitudes about agricultural biotechnology and genetically modified organisms. *The Public Opinion Quarterly* 65(2): 267–281.

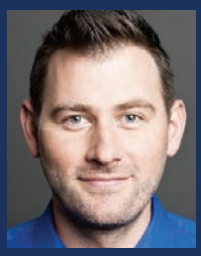
Strom, S. 2016. Campbell labels will disclose G.M.O. ingredients. *The New York Times* (January 7). Available online at http://nyti.ms/1ORR7EN.

USDA n.d. Organic market overview. United States Department of Agriculture. Available online at http://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/organic-market-overview.aspx.

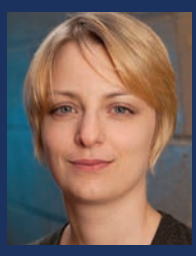
Wohlers, A.E. 2013. Labeling of genetically modified food: Closer to reality in the United States? *Politics & Life Sciences* 32(1): 73–84.

POINT OF INQUIRY WITH JOSH ZEPPS & LINDSAY BEYERSTEIN

For in-depth interviews with the most fascinating minds in science, religion, and politics, join *Point of Inquiry* cohosts Lindsay Beyerstein and Josh Zepps at pointofinquiry.org.



Josh Zepps (cohost) is a new media pioneer; a journalist serving as a founding host and producer at the online talk network HuffPost Live, following hosting stints with such outlets as Bloomberg TV, the Discovery Channel, and as an anchor for CBS's Peabody Award-winning *Channel One News*.



Lindsay Beyerstein (cohost) is an award-winning investigative journalist and staff writer for *In These Times*. Her work has appeared in places such as *The New Republic, Reuters, Slate, Salon, Ms. Magazine*, and *The New York Press*. Wait to see what stories she tells with her guests on *Point of Inquiry*.

[SKEPTICAL INQUIREE BENJAMIN RADFORD

Benjamin Radford is a research fellow at the Committee for Skeptical Inquiry and author or coauthor of seven books, including *Mysterious New Mexico: Miracles, Magic, and Monsters in the Land of Enchantment*.

U.K. Viral 'Ghost Photo' Explained

Q: Have you seen this latest ghost photo from England? There seems to be some sort of mysterious figure in a window, and it was even on *Good Morning America*.

—D. Marks

A: A "ghost photo" taken by a British woman named Natasha Oliver circulated in the news media and social media in late July 2015. It depicted about a dozen friends on a lawn and what appears to be a human head and torso in an unfinished building in the background. The form is too dark and fuzzy to be identified, but some have claimed it looks like a ghostly mother and baby. Oliver's photo was taken in 2010 but recently got widespread attention after she commented on a Facebook post about a ghost picture she thought was fake—and offered her own.

The story was featured on *Good Morning America* on July 30 under the headline "'Ghost Woman and Her Baby': Photo Shows Mysterious Figure in Window" (at http://tinyurl.com/p5rv8r6). According to the story by Avianne Tan:

> Oliver said she and her friends "freaked out" after they saw the photo on her digital camera back in 2010, taken when they were hanging out on the lawn in front of the unfinished home still being built at the time. "When we saw the ghostly figure, the boys climbed up the scaffolding to see what was up there thinking maybe someone was watching us," Oliver said. "But there was nothing up there. There were no floorboards or anything there. The house wasn't finished being built yet at the time."

While everyone loves a good ghost story, I immediately detected several reasons to be skeptical that a phantom photobombed their party picture. Though there was some speculation that the photo was faked—partly because a famous ghost photo from the same town claimed to be of a little girl killed in a fire was revealed to be a hoax—a misunderstanding seems more likely in this case.

I noticed that there were only two, nearly identical, photographs provided by Oliver, taken two minutes apart (at 21:20 and 21:22). If, as she claimed, the group immediately noticed that an odd figure seemed to be in the window

behind them and a few friends were dispatched to investigate, it seems odd that there aren't more photos of it from a closer point of view. Instead it seems that no one in the group even tried to get a better photo of it. A surprised exclamation of "Look! Is that a ghost?" during a review of a digital photograph taken moments before might be expected to result in a dozen cell phone cameras being produced to get their own photographic "proof" of the paranormal, but that did not happen.

In fact, the additional photographic evidence provided by Oliver casts doubt on her explanation; because the photos are time-stamped, and because she uploaded dozens of photographs from that June 18, 2010, event to Facebook, there is a photographic record of what the group did after the "ghost photos" were taken. The last image that shows the "ghost" was taken at 21:22, and is followed by twenty-six other photos depicting what the group did between that time and 21:52 that evening. There is not a single photograph that shows Oliver or any of her friends searching for a ghost—or even reacting to the discovery that they may have been in the presence of an undead spirit. Instead the two dozen photos show the group laughing, acting goofy, and enjoying an alcohol-fueled footballer party.

That part of the mystery was solved by a closer look at the photos, which reveals that four months had elapsed before anyone noticed the ghostly figure. I discovered that the photo was first noted on October 4, 2010, by one of Oliver's friends commenting on her Facebook photo. Therefore her quoted claim that "When we saw the ghostly figure, the boys climbed up the scaffolding to see what was up there thinking maybe someone was watching us" could not be true, since no one in her group saw the figure at the time, which explains why her photos show no investigation. Since there was no investigation at the time—and therefore no one trying to figure out what the strange form might be—the claim that looking for the ghost yielded the creepy revelation that "there was nothing up there" also could not be accurate.

There are two second-story windows visible in the ghostly photograph; in another photo later in the series, one of Oliver's friends can be seen on scaffolding in front of one of the windows. Since the ghost wasn't discovered until months later, he was not (and could not have been) searching for the ghostly intruder; instead he is posing and holding a beer about half an hour after the "ghost" photo was taken.

He may have looked in the window and saw nothing—but a closer look reveals he is at the wrong window. The ghost was photographed in the other window, on the right of the photograph. What may have happened is that he told Oliver (months later) that when he had been up there he hadn't seen anything odd and that there was nothing in that window, and he (or she) misunderstood which window he was referring to. There's no evidence that anyone even looked in the window where the "ghost" was photographed to see what was there.

Perhaps Oliver was misquoted and meant to suggest that, four months after the photo was taken, they returned to search for a cause of the figure. But by then the construction would have likely been completed, the scene changed dramatically, and the scaffolding removed. Either way, the story as it was presented on *Good Morning America* and other news media could not be accurate. A more likely explanation is that Oliver simply misremembered the circumstances of that photo five years after it was taken, and that mistake spawned a ghost mystery.

So what is the light gray, vaguely humanlike figure? It could have been a trick of light, a piece of plastic or tarp from the construction site behind the group, wooden planks propped up in the window, or any number of other things. Just because the general shape looks vaguely like a head and chest doesn't mean it is; the human brain is hardwired to look for humanlike patterns. This is a psychological phenomenon called "pareidolia," in which people see faces and figures in ambiguous forms, from clouds to stains. It's common and harmless and has caused many of the "ghost photos" I've investigated (see, for example, "The Cockington Church Ghost Photo" in the January/February 2015 SI).

It's impossible to know what was in that window five years after the photo was taken; the building has been finished and all the scaffolding and construction debris long since removed. All we are left with is a ghost story and photo. Ghosts may or may not exist, but in this case psychology—not the paranormal—provides the best explanation. ■

Just because the general shape looks vaguely like a head and chest doesn't mean it is; the human brain is hardwired to look for humanlike patterns. This is a psychological phenomenon called "pareidolia," in which people see faces and figures in ambiguous forms, from clouds to stains.

CRISPR-Cas9:
Not Just Another Scientific Revolution

Poised to transform the world as we know it, a new gene-editing system has bioethicists wringing their hands, physicians champing at the bit, and researchers dueling with demons.

KENNETH W. KRAUSE

Is it possible to overstate the potential of a new technology that efficiently and cheaply permits deliberate, specific, and multiple genomic modifications to almost anything biological? What if that technology was also capable of altering untold future generations of nearly any given species—including the one responsible for creating it? And what if it could be used, for better or worse, to rapidly exterminate an entire species?

Certain experts have no intention of veiling their enthusiasm—or their unease. Consider, for example, biologist David Baltimore, who recently chaired an international summit dedicated primarily to the technology's much-disputed ethical implications. "The unthinkable has become conceivable," he warned his audience in early December. Powerful new gene-editing techniques, he added, have placed us "on the cusp of a new era in human history."

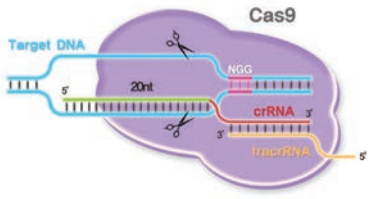
If so, it might seem somewhat anticlimactic to note that *Science* magazine dubbed this technology its "Breakthrough of the Year" for 2015, or that its primary developers are widely considered shoo-ins for a Nobel Prize—in addition, that is, to the $3 million Breakthrough Prize in Life Sciences already earned by two such researchers. All of which might sound trifling compared to the billions up for grabs following imminent resolution of a now-vicious patent dispute.

Although no gene-editing tool has ever inspired so much drama, the new technology's promise as a practical remedy for a host of dreadful diseases, including cancer, remains foremost in researchers' minds. Eager to move beyond *in vitro* and animal model applications to the clinical setting, geneticists across the globe are quickly developing improved molecular components and methods to increase the technology's accuracy. In case you haven't heard, a truly profound scientific insurrection is well underway.

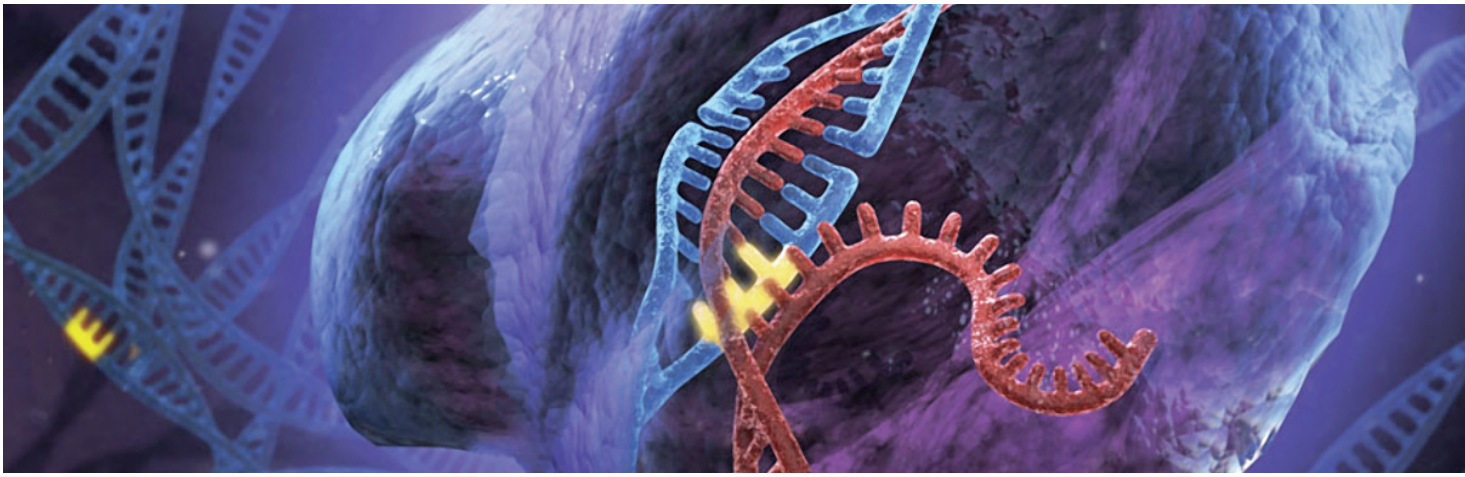
Adapting CRISPR-Cas9

"Think about a film strip. You see a particular segment of the film that you want to replace. And if you had a film splicer, you would go in and literally cut it out and piece it back together—maybe with a new clip. Imagine being able to do that in the genetic code, the code of life."—Biochemist Jennifer Doudna (CBS News 2015)

Genetic manipulation is nothing new, of course. Classic gene *therapy*, for example, typically employs a vector, often a virus, to somewhat haphazardly deliver a healthy allele somewhere in the patient's genome, hopefully to perform its desired function wherever it settles. Alternatively, RNA interference selects specific messenger RNA molecules for destruction, thus changing the way one's DNA is transcribed. Interference occurs, however, only so long as the damaging agent remains within the cell.



Contemporary *editing* techniques, on the other hand, allow biologists to actually alter DNA—the "code of life," as Doudna suggests—and to do so with specific target sequences in mind. The three major techniques have much in common. Each involves an enzyme called a "programmable nuclease," for



example, which is guided to a particular nucleotide sequence to cleave it.

Then, in each case, the cell's machinery quickly repairs the double-stranded break in one of two ways. Non-homologous end joining for gene "knock out" results when reconstruction—usually involving small, random nucleotide deletions or insertions—is performed only by the cell. Here, the gene's function is typically undermined. By contrast, homology-directed repair for gene "knock in" occurs when the cell copies a researcher's DNA repair template delivered along with the nuclease. In this case, the cleaved gene can be corrected, or a new gene or genes can be inserted (Corbyn 2015).

But in other ways, the three editing techniques are very distinct. Developed in the late 1990s and first used in human cells in 2005, zinc-finger nucleases (ZFN) attach cutting domains derived from the prokaryote *Flavobacterium okeanokoites* to proteins called "zinc fingers" that can be customized to recognize certain three-base-pair DNA codes. Devised in 2010, transcription activator-like effector nucleases (TALENs) fuse the same cutting domains to different proteins called TAL effectors. For both ZFN and TALENs, two cutting domains are necessary to cleave double-stranded DNA (Maxmen 2015).

The third and most revolutionary editing technique, and subject of this article, consists of clustered regularly interspaced short palindromic repeats (CRISPR) and a CRISPR-associated protein-9 nuclease (Cas9). Introduced as an exceptionally precise editing technique in 2012 by Doudna at the University of California, Berkeley, and microbiologist Emmanuelle Charpentier at the Max Planck Institute for Infection Biology in Berlin, CRISPR-Cas9 is actually the bacterium *Streptococcus pyogenes*' adaptive immune system that confers resistance to foreign elements, such as phages and plasmids.

But what makes the CRISPR system so special, in part, and so adaptable to the important task of gene-editing, is its relative simplicity.

CRISPR thus refers to short bits of DNA seized from invading viruses and stored in the bacterium's own genome for future reference, and Cas9 is the enzyme *S. pyogenes* uses to cleave a subsequent invader's double helix. In other words, in its native setting, CRISPR-Cas9 is the system a certain bacterium uses to recognize and disable common biological threats. Unlike ZFN and TALENs, CRISPR-Cas9 does not rely on the *F. okeanoites* cutting domain and, as such, can cleave both strands of an interloper's double helix simultaneously with a single Cas9 enzyme.

But what makes the CRISPR system so special, in part, and so adaptable to the important task of gene-editing, is its relative simplicity. Only three components are required to achieve site-specific DNA recognition and cleavage. Both a CRISPR RNA (crRNA) and a trans-activating crRNA (tracrRNA) are needed to guide the Cas9 enzyme to its target sequence. What Doudna and Charpentier revealed four years ago, however, were the seminal facts that an even simpler, two-component system could be developed by combining the crRNA and tracrRNA into a synthetic single guide RNA (sgRNA), and that researchers could readily modify a sgRNA's code to redirect the Cas9 enzyme to almost any preferred sequence (Jinek et al. 2012). Today, a biologist wanting to edit a specific sequence in an organism's genome can quickly and cheaply design an sgRNA to match that sequence, order it from a competitive manufacturer for $65 or less, and have it delivered in the mail (Petherick 2015).

None of which is to suggest that a CRISPR system is always the best tool for the gene-editing job, at least not yet. Critically, CRISPR-Cas9 is relatively easy to program and remains the only technique allowing researchers to "multiplex," or edit several genomic sites simultaneously. But TALENs have the longest DNA recognition domains and, thus, tend so far to result in the fewest "off-target effects," which occur when nucleotide sequences identical or similar to the target are cut unintentionally. And ZFNs are much smaller than either TALENs or CRISPR-Cas9, especially the most popular version derived from *S. pyogenes*, and are therefore more likely to fit into the tight confines of an adeno-associated virus (AAV)—currently the most promising vector for the delivery of gene-editing therapies.

These experiments marked the very first instances of using CRISPR to successfully treat genetic disorders in fully developed living mammals.

Even so, CRISPR research continues to progress at breakneck speed. In 2014, the number of gene-editing kits ordered from Addgene, a supplier based in Cambridge, Massachusetts, for research using ZFN and TALENs totaled less than 1,000 and less than 2,000, respectively. During that same year—only two years after the new technology was introduced—the number of kits ordered for CRISPR research totaled almost 20,000 (Corbyn 2015). More important, rapidly increasing orders seem to have translated into significant results. As 2015 ended and a new year began, new studies announcing the creation of smaller guide RNAs and, especially, the reduction of off-target effects began to dominate science headlines.

Breaking Barriers

"This is now the most powerful system we have in biology. Any biological process we care about now, we can get the comprehensive set of genes that underlie that process. That was just not possible before."

—Biochemist David Sabatini (Yong 2015)

CRISPR-Cas9, of course, is only one among many prokaryotic CRISPR systems that could, at some point, prove useful for any number of human purposes. Use of Cas9 variations, however, has already resulted in successes far too numerous to review liberally here. Even so, two recent applications in particular reveal the extraordinary, yet strikingly simple, means by which researchers have achieved previously unattainable outcomes.

In the first application, three different teams confronted Duchenne muscular dystrophy (DMD), a terrifying disease that affects about one in every 3,500 boys in the United States alone (Long et al. 2015; Nelson et al. 2015; Tabebordbar et al. 2015). DMD typically stems from defects in a gene containing seventy-nine protein-coding exons. If even a single exon suffers a debilitating mutation, the gene can be rendered incapable of producing dystrophin, a vital protein that protects muscle fibers. Absent sufficient dystrophin, both skeletal and heart muscle will deteriorate. Patients usually end up confined to wheelchairs and dead before the age of thirty.

Traditional gene therapy, stem cell treatments, and drugs have proven mostly ineffective against DMD. Scientists have corrected diseased cells *in vitro*, or in a single organ—the liver. But treating muscle cells throughout the body, including the heart, is a far more daunting task, because they can't all be removed, treated in isolation, and then replaced. And given current ethical concerns, most researchers are prohibited from even considering the possibility of editing human embryos for clinical purposes.

As such, researchers here decided to employ CRISPR-Cas9 technology to excise faulty dystrophin gene exons in both adult and neonatal mice by delivering it directly into their muscles and bloodstreams using non-pathogenic adeno-associated viruses. AAVs, however, are too small to accommodate the relatively large *S. pyogenes* Cas9, so each team opted instead to deploy a more petite Cas9 enzyme found in *Staphylococcus aureus*.

Neither group's interventions resulted in complete cures. But dystrophin production and muscle strength were restored, and little evidence of off-target effects was observed, in treated mice. One lead researcher later suggested that although clinical trials could be years away, up to 80 percent of human DMD victims could benefit from defective exon removal (Kaiser 2015).

Remarkably, each of the three teams obtained results comparable to those of the others. Perhaps most impressively, however, these experiments marked the very first instances of using CRISPR to successfully treat genetic disorders in fully developed living mammals.

But an ever-growing population needs to protect its agricultural products too. Plant DNA viruses, for exam-

ple, can cause devastating crop damage and economic crises worldwide, but especially in underdeveloped regions including sub-Saharan Africa. More specifically, the tomato yellow leaf curl virus (tomato virus) is known to ravage a variety of tomato breeds, causing stunted growth, abnormal leaf development, and fruit death.

Like DMD, the tomato virus has proven an especially intractable problem. Despite previous efforts to control it through breeding, insecticides targeting the vector, and other engineering techniques, we currently know of no effective means of managing the virus. Undeterred, another group of biologists decided to give CRISPR-Cas9-mediated viral interference a try (Ali et al. 2015).

In this study, the investigators chose to manipulate a species of tobacco plant, well-understood as a model organism, that is similarly vulnerable to tomato virus infection. The experiment was completed in two fairly predictable stages. First, the group designed sgRNAs to target certain tomato virus coding and non-coding sequences and inserted them into different, harmless viruses of the tobacco rattle variety. Second, they delivered the newly loaded rattle viruses into their tobacco plants. After seven days, the plants were exposed to the tomato virus and, after ten more days, they were analyzed for symptoms of infection.

The group agreed that the CRISPR-Cas9 system had reliably cleaved and introduced mutations to the tomato viruses' genomes. Fortuitously, every plant expressing the system had either abolished or significantly attenuated all symptoms of infection. The investigators concluded further that the technique was capable of simultaneously targeting multiple DNA viruses with a lone sgRNA, and that other transformable plant species, including tomatoes, of course, would be similarly affected.

One can only guess, at this point, how certain interests might receive these and other types of genome-edited crops. Will nations eventually classify them as GMOs or, alternatively, as organisms capable of developing in nature? Will applicable regulations focus on the processes or products of modification? Regardless, one can hardly ignore these commodities' potential windfalls, especially for those in dire need.

Given recent innovations in specificity, for example, CRISPR-based disease research will likely continue to advance quickly toward clinical and other more practical applications. So long as it affects only non-reproductive somatic cells, such interventions should remain largely uncontroversial. Human gametes and embryos, on the other hand, have once again inspired abundant debate and bitter division among experts.

Moralizing Over Science

"Genome editing in human embryos using current technologies could have unpredictable effects on future generations. This makes it dangerous and ethically unacceptable."
—Edward Lanphier et al. (2015)

"To intentionally refrain from engaging in life-saving research is to be morally responsible for the foreseeable, avoidable deaths of those who could have benefitted."
—Bioethicist Julian Savulescu et al. (2015)

The results of the first (and, so far, only) attempt to edit human embryos using CRISPR-Cas9 was published by a team of Chinese scientists on April 18 of last year (Liang et al. 2015). Led by Junjiu Huang, the group chose to experiment on donated tripronuclear zygotes—nonviable early embryos containing one egg and two sperm nuclei—neither intended nor suitable for clinical use. Their goal was to successfully edit endogenous β-globin genes that, when mutated, can cause a fatal blood disorder known as β-thalassemia.

By his own admission, Huang's outcomes were less than spectacular. Eighty-six embryos were injected with the Cas9 system and a molecular

Edward Lanphier

template designed to affect the insertion of new DNA. Of the seventy-one that survived, fifty-four embryos were tested. A mere twenty-eight were successfully spliced and, of those, only four exhibited the desired additions. Rates of off-target mutations were much higher than expected too, and the group would likely have discovered additional unintended cuts had they examined more than the protein-coding exome, which represents less than 2 percent of the entire human genome.

In all fairness, however, the embryos' abnormality might have been responsible for much of the total off-target effect. And, of course, Huang was unable to take advantage of many specificity-enhancing upgrades to the CRISPR system yet to be designed at the time of his investigations. In any case, his team acknowledged that their results "highlight the pressing need to further improve the fidelity and specificity" of the new technology, which in their opinions remained immature and unready for clinical applications.

Nevertheless, the Chinese experiment ignited a brawl among both scientists and bioethicists over the prospect of human germline modification with the most powerful and accessible gene-editing machinery ever conceived. Similar quarrels had accompanied the proliferation of technologies involving recombinant DNA, *in vitro* fertil-

Once decried as morally unacceptable, vaccinations, transfusions, artificial insemination, organ transplants, and IVF have all proven "unexceptional boons to human well-being."

ization, gene therapy, and stem cells, for example. But never had the need to address our capacity to reroute the evolution of societies—indeed, of the entire species—seemed so real and immediate.

Leading experts, including Baltimore and Doudna, had previously met in Napa, California, on January 24, 2015, to discuss the bioethical implications of rapidly emerging technologies. In the end, they "strongly discouraged . . . any attempts at germline genome modification for clinical application in humans," urged informed discussion and transparent research, and called for a prompt global summit to recommend international policies (Baltimore et al. 2015). A surge of impassioned literature ensued.

A small group led by Sangamo BioSciences president Edward Lanphier was one of the first to weigh in (Lanphier et al. 2015). Calling for a "voluntary moratorium" on all human germline research, Lanphier first expressed concerns over potential off-target effects and the genetic mosaicism that could result, for instance, if a fertilized egg began dividing before all intended corrections had occurred. He also found it difficult to "imagine a situation in which use of human embryos would offer therapeutic benefits over existing and developing methods," suggesting as well that pre-implantation genetic diagnosis (PGD) and *in vitro* fertilization (IVF) were far better options than CRISPR for parents carrying the same mutation for a genetic disease. In any case, he said, with so many unanswered questions, clinicians remained unable to obtain truly risk-informed consent from either parents looking to modify their germlines or from affected future generations. Finally, Lanphier implied that even the best intentions could eventually lead societies down a "slippery slope" toward nontherapeutic genetic enhancement and so-called "designer babies."

Harvard Medical School geneticist George Church

Francis Collins, evangelical Christian and director of the National Institutes of Health (which currently refuses to fund human germline research), expressed similar views regarding the sufficiency of PGD and IVF, the impossibility of informed consent, and nontherapeutic enhancement (Skerrett 2015). In addition, Collins worries that access to the technology would be denied to the economically disadvantaged and that parents might begin to conceive of their children "more like commodities than precious gifts." For the director, given the "paucity of compelling cases" in favor of such research, and the significance of the ethical counterarguments, "the balance of the debate leans overwhelmingly against human germline engineering."

On the other hand, Harvard Medical School geneticist George Church urges us to ignore pleas for artificially imposed bans, "encourage the innovators," and focus more on what he deems the obvious benefits of germline research (Church 2015). Responding to Lanphier and Collins, he argues as well that, without obtaining consent, parents have long exposed future generations to mutagenic forces—through chemotherapy, residence in high-altitudes, and alcohol intake, for example. We have also consistently chosen to enhance our offspring and future generations through mate choice, among many other things. Church also points out that PGD during the IVF procedure is incapable of offering solutions to individuals possessing two copies of a detrimental, dominant allele, or to prospective parents who both carry two copies of a harmful, recessive allele. Moreover, in most instances, PGD cannot be used to avoid more complex polygenic diseases, including schizophrenia. Nor can we presume that new technology costs will al ways create treatment or enhancement inequities. In fact, according to Church, the price of DNA sequencing, for example, has already plummeted more than three million fold. Finally, germline editing is probably not irreversible, Church contends, and certainly not as error-prone at this point as many have suggested. "Senseless" bans, he concludes, would only "put a damper on the best medical research and instead drive the practice underground to black markets and uncontrolled medical tourism."

Taking a slightly different tack, Harvard cognitive scientist Steven Pinker censures bioethicists generally for getting bogged down in "red-tape, moratoria, or threats of prosecution based on nebulous but sweeping principles such as 'dignity,' 'sacredness,' or 'social justice'" (Pinker 2015a). Imploring the bioethical community to "get out of the way" of CRISPR, Pinker reminds them that, once decried as morally unacceptable, vaccinations, transfusions, artificial insemination, organ transplants, and IVF have all proven "unexceptional boons to human well-being." Further, the specific harms of which moratorium proponents warn, including cancer, mutations, and birth defects, "are already ruled out by a plethora of ex-

isting regulations and norms" (Pinker 2015b). In the end, he advises, both scientists and everyday people need and deserve a well-diversified research portfolio. "If you ban something, the probability that people will benefit is zero. If you don't ban it, the probability is greater than zero."

Such were among the arguments considered by a committee of twelve biologists, physicians, and ethicists during the December 2015 International Summit on Human Genome Editing, organized by the U.S. National Academies of Sciences and Medicine, the Royal Society in London, and the Chinese Academy of Sciences. The Summit was chaired by David Baltimore. Doudna and Charpentier, winners of the $3 million Breakthrough Prize in Life Sciences, attended with synthetic biologist Feng Zhang—a now much-celebrated trio considered front runners for a Nobel Prize, though also entangled through their institutions in a CRISPR patent dispute potentially worth billions of dollars.

After three days of discussion, the Summit's organizing committee issued a general statement rejecting calls for a comprehensive moratorium on germline research (National Academies of Science 2015). The members did, however, advise without exception against the use of edited embryos to establish pregnancy. "It would be irresponsible to proceed," they added, "with any clinical use of germline editing" until safety and efficacy issues are resolved and there exists "a broad societal consensus about the appropriateness of the proposed application." In conclusion, the committee called for an "ongoing forum" to harmonize the current global patchwork of relevant regulations and guidelines and to "discourage unacceptable activities." This forum, the members judged, should consist not only of experts and policymakers but of "faith leaders," "public interest advocates," and "members of the general public" as well.

Wasting little time, the UK's Human Fertilization and Embryology Authority approved on February 1, 2016, the first attempt to edit *healthy* human embryos with the CRISPR-Cas9 system. The application was filed last September by developmental biologist Kathy Niakan of the Francis Crick Institute in London. Niakan intends to use CRISPR to knock out one of four different genes in a total of 120-day-old, IVF-donated embryos to investigate the roles such genes play in early development.

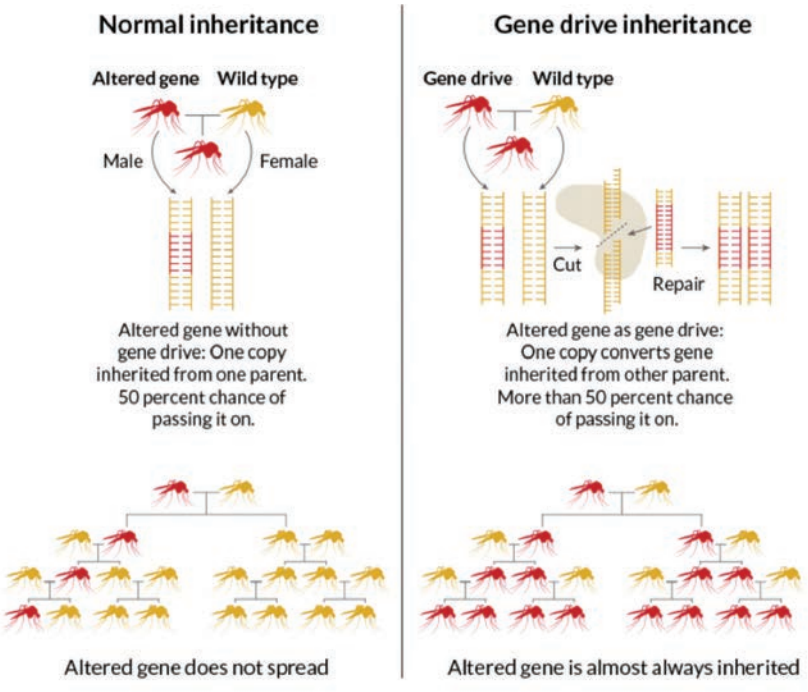
Her research could help identify genes crucial to early human growth and cell differentiation and, thus, lead to more productive IVF cultures and more informed selection practices. It could also reveal mutations that lead to miscarriages and, one day, allow parents to correct these problems through gene therapy. Following careful observation, Niakan intends to destroy her embryos by the time they reach the blastocyst stage on the seventh day. Under British law, experimental embryos cannot be used to establish pregnancy.

But the human germline is not the only, or even most pressing, subject of CRISPR controversy. Some, for example, warn of the creation of dangerous pathogens and biological warfare (Greely 2016). But many others, including Doudna, urge that we quickly address "other potentially harmful applications . . . in non-human systems, such as the alteration of insect DNA to 'drive' certain genes into a population" (Doudna 2015).

Driving DNA

"Clearly, the technology described here is not to be used lightly. Given the suffering caused by some species, neither is it obviously one to be ignored." —Evolutionary geneticist Austin Burt (2003)

In broad terms, a "gene drive" can be characterized as a targeted contagion intended to spread through a population with exceptional haste. Burt pioneered the technology through his study of transposable elements—"selfish" and often parasitic DNA sequences that exist merely to propagate themselves.


Normal inheritance
Altered gene
Wild type
Male
Female
Altered gene without gene drive: One copy inherited from one parent. 50 percent chance of passing it on.
Altered gene does not spread
Gene drive inheritance
Gene drive
Wild type
Cut
Repair
Altered gene as gene drive: One copy converts gene inherited from other parent. More than 50 percent chance of passing it on.
Altered gene is almost always inherited

Evolutionary geneticist Burt Austin believes we can use gene drives to weaken or even eradicate mosquito-transmitted diseases such as malaria and dengue fever.

Importantly, transposons can circumvent the normal Mendelian rules of inheritance dictating that any given gene has a 50 percent chance of being passed from parent to offspring.

Thirteen years ago, Burt envisioned the use of a microbial transposon-like element called a "homing endonuclease" for humanity's benefit. When inserted into one chromosome, the endonuclease would cut the matching chromosome inherited from the other parent. The cell would then quickly repair the cut, often using the first chromosome as a template. As such, the assailed sequence in the second chromosome would be converted to the sequence of the selfish element. In a newly fertilized egg, the endonuclease would likewise convert the other parent's DNA and, eventually, drive itself into the genomes of nearly 100 percent of the population.

Burt believes we can use gene drives to weaken or even eradicate mosquito-transmitted diseases such as malaria and dengue fever. If scientists engineered just 1 percent of a mosquito population to carry such a drive, he calculates, about 99 percent would possess it in only twenty generations. In fact, Burt announced five years ago that he had created a homing endonuclease capable of locating and cutting a mosquito gene (Windbichler et al. 2011). However, his elements were difficult to program for precise application.

Enter CRISPR-Cas9. As we've seen, Cas9 is an eager endonuclease, and guide RNAs are easy to program and can be quickly synthesized. In April of last year, biologists Valentonio Gantz and Ethan Bier revealed that they had used CRISPR-Cas9 to drive color variation into *Drosophila* fruit flies (Gantz and Bier 2015). Though they labeled it a "mutagenic chain reaction" at the time, it was the first gene drive ever deployed in a multicellular organism.

Today, researchers sort potential gene drives into two major groups. Replacement drives seek only to displace natural with modified populations. Suppression drives, by contrast, attempt to reduce or even eradicate populations. At this point, no drives have been released into the wild. Nevertheless, researchers have lately designed one of each type to affect mosquitos carrying the deadly human malaria parasite, *Plasmodium falciparum*.

The first study was led by microbiologist Anthony James, who collaborated on the project with Gantz and Bier (Gantz et al. 2015). Focusing on the prevention of disease transmission, this group engineered Anopheles stephensi mosquitos, highly active in urban India, to carry two transgenes producing antibodies against the malaria parasite, a CRISPR-Cas9-mediated gene drive and a marker gene. Because the very lengthy payload rendered insertion a challenging process, James was able to isolate only two drive-bearing males among 25,000 larvae. But when mated with wild-type females, these and subsequent transgenic males spread their anti-malaria genes at an impressive rate of 99.5 percent. Transgenic females, on the other hand, processed the drive quite differently and passed it on at near-normal Mendelian ratios.

Despite its overall success, James doesn't imagine that his team's replacement drive could eliminate the malaria parasite independently. Instead, he envisions its use to reduce the risk of infection and to complement other strategies already being employed. Even so, because such drives would not exterminate *P. falciparum* or its mosquito vector, they would potentially allow the parasite to one day evolve resistance to their transgene components.

The second study's goal was quite different. Here, molecular biologist Tony Nolan, along with Burt and others, first identified three genes in the *Anopheles gambiae* mosquito, active in sub-Saharan Africa, that when mutated

cause recessive infertility in females (Hammond et al. 2016). Second, they designed a CRISPR-Cas9 gene drive to target and edit each gene. Following insertion, they bred their transgenic mosquitos with wild-types and found that nearly all female offspring were born infertile. In a subsequent experiment, Nolan released 600 vectors—half transgenic, half wild-type—into a cage. After only four generations, 75 percent of the population carried the mutations, exactly what one would expect from an effective gene drive.

A suppression drive like Hammond's could, in theory, eliminate a parasite's primary vector. In such a scenario, the parasite might find another means of conveying the disease to humans; more than 800 species of mosquito inhabit Africa alone, for example. But it might not. The loss would also substantially alter the relevant ecosystem. But despite other methods of controlling the disease, malaria still claims more than a half million lives every year, mostly among children under five.

Even in theory, no gene drive is a panacea. They function only in sexually reproducing species, and best in species that reproduce very rapidly. Nor would their effects be permanent—most transgenes would prove especially vulnerable to evolutionary deselection, for example. But neither would they turn out as problematic as some might imagine. They can be easily detected through genome sequencing, for instance, and are unlikely to spread accidentally into domesticated species. And if scientists sought for whatever reason to reverse the effects of a previously released drive, they could probably do so with the release of a subsequent drive.

As Church and others have recently suggested, it "doesn't really make sense to ask whether we should use gene drives. Rather, we'll need to ask whether it's a good idea to consider driving *this particular change* through *this particular population*" (Esvelt et al. 2014). ■

References

Ali, Z., A. Abulfaraj, Ali Idris, et al. 2015. CRISPR/Cas9-mediated viral interference in plants. *Genome Biology* 16: 238 DOI:10.1186/s13059-015-0799-6.

Baltimore, D., P. Berg, M. Botcham, et al. 2015. A prudent path forward for genomic engineering and germline gene modification. *Science* 348(6230): 36–38.

Burt, A. 2003. Site-specific selfish genes as tools for the control and genetic engineering of natural populations. *Proceedings of the Royal Society B* 270: 921–928.

CBS News. 2015. Could Revolutionary Gene-editing Technology End Cancer? Available online at http://www.cbsnews.com/news/crispr-jennifer-doudna-gene-editing-technology-diseases-dangers-ethics/; accessed January 25, 2016.

Church, G., 2015. Encourage the innovators. *Nature* 528: S7.

Corbyn, Z. 2015. Biology's big hit. *Nature* 528: S4–S5.

Doudna, J. 2015. Embryo editing needs scrutiny. *Nature* 528: S6.

Esvelt, K., G. Church, and J. Lunshof. 2014. "Gene Drives" and CRISPR Could Revolutionize Ecosystem Management. Available online at http://blogs.scientificamerican.com/guest-blog/gene-drives-and-crispr-could-revolutionize-ecosystem-management/; accessed February 6, 2016.

Gantz, V.M., and E. Bier. 2015. The mutagenic chain reaction: A method for converting heterozygous to homozygous mutations. *Science* 348(6233): 442–444.

Gantz, V.M., N. Jasinskiene, O. Tatarenkova, et al. 2015. Highly efficient Cas9-mediated gene drive for population modification of the malaria vector mosquito *Anopheles stephensi*. *Proceedings of the National Academy of Sciences* DOI: 10.1073/pnas.1521077112.

Greely, H.T. 2016. Are We Ready for Genetically Modified Animals? Available online at http://www.weforum.org/agenda/2016/01/are-we-ready-for-genetically-modified-animals; accessed February 3, 2016.

Hammond, A., R. Galizi, K. Kyrou, et al. 2016. A CRISPR-Cas9 gene drive system targeting female reproduction in the malaria mosquito vector *Anopheles gambiae*. *Nature Biotechnology* DOI: 10.1038/nbt.3439.

Jinek, M., K. Chylinski, I. Fonfara, et al. 2012. A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. *Science* 337: 816–821.

Kaiser, J. 2015. CRISPR Helps Heal Mice With Muscular Dystrophy. Available online at http://www.sciencemag.org/news/2015/12/crispr-helps-heal-mice-muscular-dystrophy; accessed January 30, 2015.

Lanphier, E., F. Urnov, S.E. Ehlen, et al. 2015. Don't edit the human germline. *Nature* 519: 410–411.

Liang, P., Y. Xu, X. Zhang, et al. 2015. CRISPR/Cas9-mediated gene editing in human tripronuclear zygotes. Protein Cell 6(5): 363–372.

Long, C., L. Amoasii, A.A. Mireault, et al. 2015. Postnatal genome editing partially restores dystrophin expression in a mouse model of muscular dystrophy. *Science* DOI: 10.1126/science.aad5725.

Maxmen, A. 2015. Three technologies that changed genetics. *Nature* 528: S2–S3.

National Academies of Science. 2015. International Summit Statement. Available online at http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12032015a; accessed January 2, 2016.

Nelson, C.E., C.H. Hakim, D.G. Ousterout, et al. 2015. In vivo genome editing improves muscle function in a mouse model of Duchenne muscular dystrophy. *Science* DOI: 10.1126/science.aad5143.

Petherick, A. 2015. Nature outlook genome editing. *Nature* 528: S1.

Pinker, S. 2015a. The Moral Imperative for Bioethics. Available online at https://www.bostonglobe.com/opinion/2015/07/31/the-moral-imperative-for-bioethics/JmEkoyzlTAu9oQV76JrK9N/story.html; accessed February 2, 2016.

———.2015b. Steven Pinker Interview. Available online at https://www.ipscell.com/2015/08/stevenpinker/; accessed February 2, 2016.

Savulescu, J., J. Pugh, T. Douglas, et al. 2015. The moral imperative to continue gene editing research on human embryos. *Protein Cell* 6(7): 476–479.

Skerrett, P. 2015. First Opinion. A Debate: Should We Edit the Human Genome? Available online at http://www.statnews.com/2015/11/30/gene-editing-crispr-germline/; accessed February 2, 2016.

Tabebordbar, M., K. Zhu, J.K.W. Cheng, et al. 2015. In vivo gene editing in dystrophic mouse and muscle stem cells. *Science* DOI: 10.1126/science.aad5177.

Windbichler, N., M. Menichelli, P.A. Papathanos, et al. 2011. A synthetic homing endonuclease-based gene drive system in the human malaria mosquito. *Nature* 473: 212–215.

Yong, E. 2015. The New Gene-editing Technique that Reveals Cancer's Weak nesses. Available online at http://www.theatlantic.com/science/archive/2015/11/a-revolutionary-gene-editing-technique-reveals-cancers-weaknesses/417495/; accessed on January 30, 2016.

Kenneth W. Krause is a contributing editor and "Science Watch" columnist for the SKEPTICAL INQUIRER and *The Doting Skeptic at* http://thedoting-skeptic.wordpress.com. He may be contacted at krausekc@msn.com.

CREATORS OF THE PARANORMAL

A handful of twentieth-century figures "created" the modern concept of the paranormal and its leading topics, transporting fantasy, myth, or speculation into a kind of believable "reality." Most proved to be a chimera.

JOE NICKELL

Much of what is called "the paranormal" today has intrigued mankind since the most ancient times. The term refers to those things that are supposedly beyond the normal range of science and human experience—ghosts, strange lights in the sky, psychic phenomena, and the like. It includes the supernatural but also things such as monsters that—if they exist—might be quite natural.

With the advent of modern spiritualism in 1848, launched by the Fox Sisters' hoaxed messages from the ghost of a murdered peddler (Nickell 2004, 31–32), the paranormal began to proliferate and to attract advocacy groups such as the British Society for Psychical Research. Founded in London in 1882, it was concerned with alleged psychic phenomena and the supposed survival of consciousness following bodily death (Guiley 2000, 304).

The paranormal grew increasingly throughout the twentieth century with various "new" (either substantially new or newly refocused-on) topics being expanded by individual gurus and groups of enthusiasts, and many cross-correspondences developing (say, between UFOs and Bigfoot). This article is a discussion of the "creation" of the paranormal by a series of major figures, each of whom took a concept—some fantasy, myth, or speculation—and transformed it into "reality" (Keel 2001b). (I have, of course, excluded a long list of topics—from astrology to zombies—whose origins are ancient.)

CHARLES FORT: PROPHET OF THE UNEXPLAINED

In the early twentieth century, Charles Fort (1874–1932) began the work that led one biographer to call him the "Prophet of the Unexplained" (Knight 1970). Having come into an inheritance that permitted him to engage in armchair endeavors, Fort spent his last twenty-six years scouring old periodicals for reports of alleged occurrences that science was supposedly unable to explain: UFOs (before there was such a term), archaeological oddities, mystery creatures, ghosts, rains of fish, and other anomalies—what would come to be called "fortean phenomena." Fort was not himself an investigator, and his anecdotal evidence left much to be desired (Nickell 2004, 335–337).

Nevertheless, Fort was a major innovator. In an excellent biography of him, Jim Steinmeyer (2008, xv) states, "What Fort invented was our modern view of the paranormal." Others had pointed out strange occurrences and asked why they happened, but Charles Fort championed their significance and accused science of being too conventional to care. Many of today's paranormal claims can be traced to Fort's writings.

HARRY PRICE: THE ORIGINAL GHOST HUNTER

Supposed communication with spirits of the dead is at least as old as the Biblical "Witch of Endor" who, at the behest of King Saul, allegedly conjured up the ghost of Samuel (I Samuel 28). From the first century CE came a prototypical chain-rattling ghost at a house in Athens investigated by one Athenodorus who allegedly observed the specter and laid it to rest (Nickell 2012a, 17–18). This is an early example of what folklorists call a "legend trip": a visit to a site to test a legend there (Brunvand 1996, 437–440). As spiritualism developed in the mid-nineteenth century, photography was soon adopted to make "spirit photos"—first faked by William Mumler in Boston in 1862 (Nickell 2012a, 298–300).

The instigator of today's ghost-hunting craze was England's Harry Price (1881–1948), who was among the first to use "modern technology" to detect spirits of the dead and for that purpose famously had a "ghost-hunting" kit (see Price 1936, photo facing p. 32). He employed such devices as a camera with infrared filter and film (for photographing in the dark), "an electronic signaling instrument" (for detecting an object's movement from anywhere in a house), and "a sensitive transmitting thermograph" (to measure temperature variations). Along with a notebook, flashlight, and other utility items, he included a flask of brandy in case anyone fainted (Price 1940, 107).

Along with a notebook, flashlight, and other utility items, Harry Price included a flask of brandy in case anyone fainted.

Having married an heiress, Price could indulge his interests in psychical research beginning in the 1920s. Although he was a member of the Society for Psychical Research, the organization's skepticism of much physical phenomena led him to found his own lab. He combined the use of gadgetry with mediums and séances but was never able to prove the reality of ghosts. Worse, he remains suspected of trickery in some of his own investigations, including that of the Borley Rectory, the subject of his *The Most Haunted House in England* (1940). Although he posed as a scientist, Price was a school dropout whose use of scientific methods was an act, and he sought only to prove his ideas—not rigorously test them (Morris 2006, xv; Guiley 2000, 299; Nickell 2012a, 261–263).

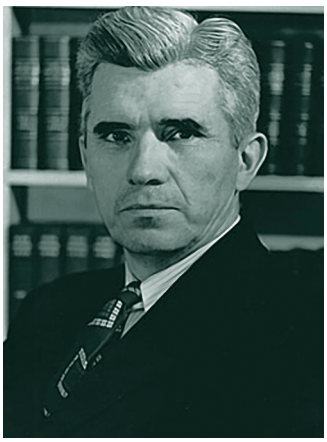
Nevertheless, Price was followed by huckster Hans Holzer (1920–2009), who cranked out books about his visits to supposedly haunted houses with psychics in tow—in one instance earning him a scathing assessment from the *Journal of the Society for Psychical Research*. More recently, television's *Ghost Hunters* and their countless imitators have taken mystery mongering to new lows. Besides the dubious legends and pseudoscience, it appears they are often merely detecting themselves (Nickell 2012a, 263–264, 275–280).

RAYMOND A. PALMER: THE MAN WHO 'INVENTED' UFOS

Whether or not the label is "exaggerated," as UFO historian Jerome Clark (1998, 2: 695) finds, many knowledgeable persons regard Ray Palmer as "the man who invented flying saucers" (Keel 2001a, 536). Certainly, the idea of airships was a much earlier one stemming from science-fiction writers, such as Jules Verne and H.G. Wells. Expectations aroused by science fiction no doubt helped spark the "Airship Wave"—the aerial-phenomena hysteria that plagued the United States between November 1896 and May 1897, preceding the modern wave of reports that began half a century later. After World War I, Charles Fort, the previously mentioned "Prophet of the Unexplained," included unidentified objects in the sky among his discussions of mysterious phenomena, earning him the further appellation "the world's first UFOlogist" (Clark 1992, 21–23), by suggesting the objects indicated visits from space aliens.

Enter Raymond A. Palmer (1910–1977). Although a childhood accident left him a hunchback of short stature, Palmer's runaway imagination and audac-

Palmer answered, "What would you say if I told you the whole thing was a joke?"



ity—including his unrelenting self-promotion—made him "something of a giant," says Clark (1998, 2: 695). Obsessed with science fiction, Palmer created in 1933 the Jules Verne Prize Club. In 1938, he became editor of the first science-fiction magazine, *Amazing Stories* (founded by Hugo Gernsback in 1926), its wild action tales prompting critics to label it "space opera." He was cofounder of *Fate* in 1948 and publisher of other magazines, including *Other Worlds*, which evolved into *Flying Saucers*, during the 1950s. He also published other writers' books on flying saucers, so-called "contactees" (those supposedly chosen to receive the wisdom of the "Space Brothers"), and other topics (Clark 1998, 2: 694–696; see also the biography of Palmer [Nadis 2013]).

Today largely forgotten, Palmer played a huge role in UFOlogy. He filled *Amazing Stories* with tales and articles hyping the "Shaver Mystery." Based on one Richard S. Shaver, this featured a race of freakish creatures called "Deros" who lived in the hollow Earth. Palmer bought reams of material from Shaver, rewrote it, and added stories he penned himself under various pseudonyms. Responses poured in from readers who told of seeing strange objects in the sky and encountering alien beings (Keel 2001b). On the back cover of *Amazing Stories*' August 1946 issue were depicted flying discs that, less than a year later, would launch the era of "flying saucers" (Clark 1998, 2: 695; Nickell 2014). On June 24, 1947, private pilot Kenneth Arnold saw nine objects in a five-mile-long formation moving like "a saucer skipped across water"—probably a phenomenon called "mountain-top mirages" (McGaha and Nickell 2014).

In any case, Ray Palmer latched onto the "flying saucer" witness. About a month after Arnold's sighting, Palmer hired him to investigate another saucer case in Washington State, though unfortunately the credulous Arnold was taken in by what is now known as the Maury Island Hoax (Sachs 1980, 191–192; Clark 1998, 2: 612–614). When the premier issue of Palmer's *Fate* magazine first appeared in the spring of 1948, its cover story was by Kenneth Arnold, and it gained national attention. In 1952, Arnold wrote, with Palmer, a book titled *The Coming of the Saucers*. By then UFOs—that is, meteors, stars and planets, balloons, various aircraft, and other mundane phenomena, sometimes seen under unusual conditions such as temperature inversions—were beginning to become "real" presumed extraterrestrial craft. While Jerome Clark (1998, 2: 695) insists, "The UFO phenomenon is the creation not of one man but of tens of thousands of UFO sightings," this is rather like observing that the Wright Brothers did not create the aircraft industry. To the extent that one man "invented" UFOs—that is, more than any other single person transformed them from fiction to seeming reality—that man was Raymond A. Palmer. Once in 1965, my late friend James W. Moseley (himself a saucer satirist) asked Palmer what he thought about flying saucers. Palmer answered, "What would you say if I told you the whole thing was a joke?" (Sachs 1980, 238).

DR. J.B. RHINE: THE 'DISCOVERER' OF ESP

The term *extrasensory perception* (ESP) refers to the alleged ability to acquire information by means other than through the known senses, and it would include *telepathy* (mind reading), *clairvoyance* (remote viewing), *precognition* (future knowledge), and *retrocognition* (paranormal knowledge of past events). Together with *psychokinesis* (PK, mind over matter), it constitutes what parapsychologists refer to as "psi" to describe two seemingly closely related phenomena. In fact, however, "psi" has never been proven, and, despite extensive research over many decades, there is still a lack of both scientific evidence and theory for its existence (Alcock 1996).

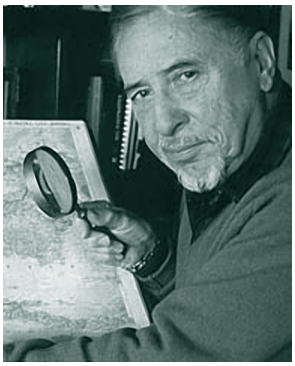
Although there were ancient seers and psychics, the modern interests in such phenomena paralleled rapid developments in science (such as the discoveries of X-rays and radio waves) and scientific reasoning (such as Darwin's theory of evolution). Interest was also stimulated by the mid-nineteenth century spiritualist craze. When, in 1882, in London, a small band of scientists and spiritualists founded the

Society for Psychical Research (SPR), unfortunately, their credulity, even outright gullibility, did not serve them well—and some members such as Harry Price, the ghost hunter, found the society too skeptical (Alcock 1996; Nickell 2012a, 21–22, 195–199, 261).

Despite the SPR's work, it fell to a botanist, Dr. J.B. Rhine (1895–1980), to attempt to establish psi as a scientific reality. He and his wife, Louisa, wished to establish that the soul existed and hoped to use psychical research (soon called "parapsychology") to link religion and science. Unfortunately, in 1929, the credulous Rhines were taken in by a "mind-reading" horse named Lady Wonder. Lady appeared to be telepathic, nudging levers to activate alphabet cards and spell out answers to queries, but she was in fact responding to subtle cues from her trainer (Nickell 2004, 279–280).

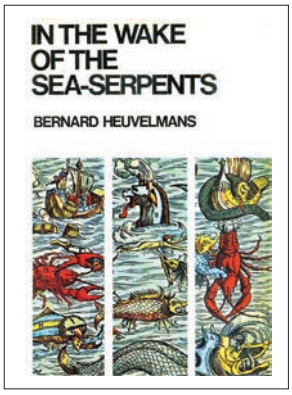
Nevertheless, Rhine's parapsychology laboratory at Duke University—founded in 1940—pioneered in ESP research. His card tests—involving a subject's guessing the sequence of symbols on a special deck of cards—seemed to begin to offer proof of a phenomenon for which he had coined the term *Extra-Sensory Perception* (as the title of a monograph in 1934). However, the tests were plagued with criticisms that subjects were allowed to handle the cards, that cheating was possible and not adequately guarded against, that the statistical analyses were flawed, and so on. Moreover, when Rhine tightened the controls, the scores went down. Rhine died having never convinced mainstream science that either ESP or psychokinesis was real (Alcock 1996; Hansel 1966).

Even so, Rhine became the most famous parapsychologist in America, his name almost synonymous with ESP. He dominated the field until his death, and even then left an indelible mark on it.



BERNARD HEUVELMANS: 'FATHER OF CRYPTOZOOLOGY'

The term *cryptozoology*—the study of unknown or "hidden" creatures (i.e., *cryptids*)—has been found in use as early as 1941 (Loxton and Prothero 2013, 16). It applies to such purported creatures as sea serpents, the Loch Ness monster, the Yeti, Bigfoot (each discussed here in turn), and many others.



Although sea serpents are reported from ancient times, it was British hydrographer and author Rupert T. Gould (1890–1948) who presented them seriously to readers, beginning in 1930 with his book *The Case for the Sea-Serpent*. (This was followed by Bernard Heuvelmans's *In the Wake of the Sea-Serpents* in 1968.) Gould went on to also promote river and lake creatures in articles, radio broadcasts, and his 1934 book, *The Loch Ness Monster and Others* (Keel 2001b). Such creatures typically prove to be the misidentification of known creatures (such as otters swimming in a line), or other mundane phenomena, or hoaxes (Nickell 1995, 238–243; 2013a).

Another cryptozoologist was Ivan T. Sanderson (1911–1973), whose important writings on the subject included *There Could Be Dinosaurs* (1948) and *Investigating the Unexplained: A Compendium of Disquieting Mysteries of the Natural World* (1972). His 1961 *Abominable Snowmen: Legend Come to Life* helped turn the Yeti into supposed evidence for Bigfoot. For example, a footprint many believed to be that of a Himalayan Yeti (but more likely an animal track altered and enlarged by melting snow) helped set the stage for the appearance of giant footprints in 1958 at Bluff Creek in northern California, leading to the creature being dubbed "Bigfoot." In 2002, the tracks were revealed as a hoax by Ray Wallace (Nickell 2011, 68).

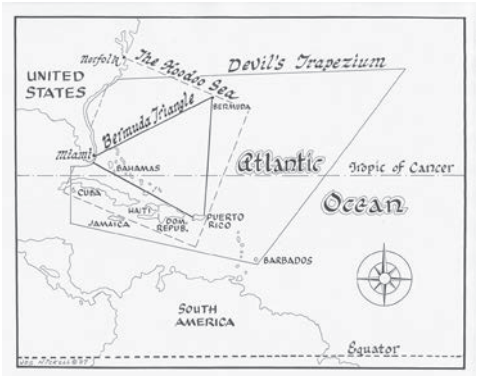
The "Minnesota Iceman" hoax—supposedly a Sasquatch or a Neanderthal man frozen in ice.

In 1967, Bigfoot enthusiast Roger Patterson set out to film the creature at Bluff Creek and returned with footage showing what was more recently revealed as Patterson acquaintance Bob Heironimus wearing a gorilla suit bought from costumer Phil Morris and modified (Nickell 2011, 68–72). Meanwhile, books on the man-beast had begun to proliferate, including Patterson's *Do Abominable Snowmen of American Really Exist?* (1966) and John Green's *Sasquatch: The Apes Among Us* (1978). Many Bigfoot sightings are attributable to what I call the "Bigfoot Bear"—that is, any bear standing upright and even walking on its hind legs—such lookalikes typi-

cally being found in bear country and engaging in bearlike activity (Nickell 2013b).

Despite all these paranormal claims, the man usually designated the "Father of Cryptozoology" is Bernard Heuvelmans (1916–2001) (Coleman and Clark 1999, 161). Another claimant for the title would be his friend, the previously mentioned Ivan T. Sanderson; both were taken in by the "Minnesota Iceman" hoax—supposedly a Sasquatch or a Neanderthal man frozen in ice but actually the work of a Disneyland model maker (Nickell 2011, 87–90). However, it was actually Heuvelmans who did the most to create the field of cryptozoology, first with his serious 1955 book, *Sur la Piste des Bêtes Ignorées* (republished in English, *On the Track of Unknown Animals*, 1958, 1962), then with his many additional books, his founding a Center for Cryptozoology in 1975 and being elected first president of the International Society of Cryptozoology at its founding in 1982 (Coleman and Clark 1999, 105–108).

VINCENT H. GADDIS: THE BERMUDA TRIANGULATOR



Map of the "Bermuda Triangle" and some other such alleged regions. (Map by Joe Nickell)

The concept of an area of the Atlantic where ships and planes mysteriously disappear can be traced to a Miami Associated Press (AP) writer, E(dward) V(an) W(inkle) Jones. His article appeared in the *Miami Herald*, September 17, 1950, and was accompanied by an AP map showing Bermuda, Miami, and Puerto Rico partially connected by dashed lines approximating a triangle. Jones (1950) vaguely referred to a "misty limbo of the lost." Two years later, writing in *Fate* magazine, George X. Sands (1952) expanded Jones's article (without citing him or other sources), and added the word *triangle* and a heavy dose of mystification.

Others also began to get onto the little bandwagon started by E.V.W. Jones, and soon there was a caravan. The flying saucer hucksters fell in behind (e.g., Morris Jessup with *The Case for the UFO*, 1955, and Donald Keyhoe with *The Flying Saucer Conspiracy*, 1957), as did writers of the "strange" genre (including Frank Edwards with *Stranger Than Science*, 1959) and others.

It remained for Vincent Gaddis (1913–1997)—a writer who once made up "filler" stories for Raymond Palmer as "a matter of livelihood" (Gaddis 1991, 16–17)—to get out in front and lead the burgeoning effort. His article in the February 1964 *Argosy* landed on major American newsstands and gave the mystery area a definitive name and ominous tone: "The Deadly Bermuda Triangle." Gaddis followed a year later with a book on sea mysteries, *Invisible Horizons* (1965), in which a chapter gave an alternate, even more ominous name for the area, "The Triangle of Death." Many joined Gaddis with books of their own. John Wallace Spencer's 1969 self-published book borrowed its title from E.V.W. Jones but pretended otherwise, referring to an area "that I call the 'Limbo of the Lost.'" (Spencer loaded his auto with books that he then promoted on talk shows, until Bantam Books transformed the work into a bestselling paperback in 1973 [Kusche 1996, 104].)

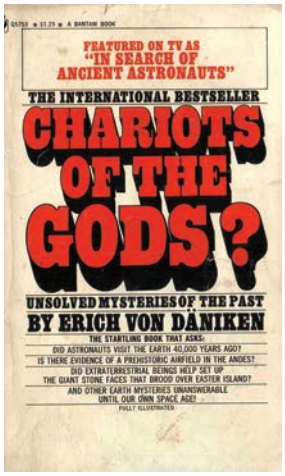
In fact there was no clear "triangle," and writers proposed greatly varying sizes and even different shapes, including a rough square called "The Hoodoo Sea" and another very large configuration, "Devil's Trapezium" (Nickell 2007, 5). Worse, reports authority Lawrence David Kusche (1996, 102), "Many of the losses that are credited to the Bermuda Triangle actually occurred nowhere near it, but near Ireland, Newfoundland, in the Pacific Ocean!" Ivan Sanderson took things further into the ridiculous, discovering there to be not just one jinx area but a dozen, his article for the pulp *Saga* (October 1972) being titled "The 12 Devil's Graveyards Around the World." (Reprinted in Ebon 1975.) Some were over land, Sanderson opined, and he called their shapes "Lozanges" (Sanderson 1975, 15–25). Much of the information on which these "Vile Vortices" were based was false or imaginary (Kusche 1996, 114). Still other writers

followed, notably Richard Winer with his *The Devil's Triangle* and Charles Berlitz with his *The Bermuda Triangle*—both bestsellers published in 1974.

Meanwhile, the impressive investigation by Kusche—*The Bermuda Triangle Mystery—Solved* (1975)—used original records and detective work to take the mystery from the mystery mongers. Kusche provided prosaic explanations—severe weather, human error, and equipment failure among them—to case after misrepresented case. For example, the 1963 "disappearance" of the *S.S. Marine Sulphur Queen* was instead an accident caused by structural weakening due to the removal of bulkheads to accommodate vats containing tons of molten sulfur; wreckage was found, including the name board reading "ARINE SULPH" between its shattered ends (Kusche 1975, 206–216). Still, of course, the claims continued. (I have myself responded to some of them, including for an episode of National Geographic Television's *Is It Real?* [2006; see also Nickell 2007]. Kusche revisited the subject in his recent Skeptical Inquirer cover article on the fortieth anniversary of his book, calling the "mystery" of the Bermuda Triangle "one of the most widespread frauds that has ever been perpetrated" (Kusche 2015, 36).

ERICH VON DÄNIKEN: CHARIOTEER OF THE GODS

The modern ancient-astronauts craze was sparked in 1968 with the publication of Erich von Däniken's *Chariots of the Gods?*—a book that consistently underestimates the abilities of ancient peoples and assigns many of their impressive works to visiting extraterrestrials. Von Däniken (b. 1935) wrote several other books capitalizing on the worldwide success of his first—works that scholars and scientists label pseudohistory and pseudoarchaeology—and other writers followed suit.

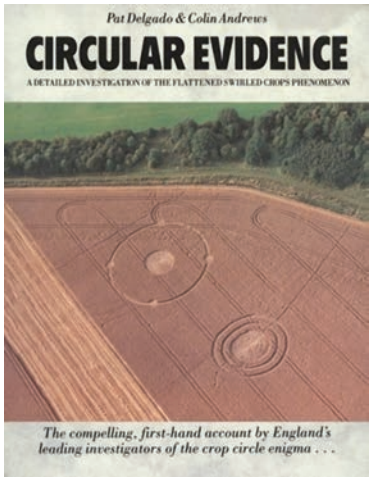

FEATURED ON TV AS
"IN SEARCH OF
ANCIENT ASTRONAUTS"
THE INTERNATIONAL BESTSELLER
CHARIOTS
OF THE
GODS?
UNSOLVED MYSTERIES OF THE PAST
BY ERICH VON DÄNIKEN
THE STARTLING BOOK THAT ASKS:
DID ASTRONAUTS VISIT THE EARTH 40,000 YEARS AGO?
IS THERE EVIDENCE OF A PREHISTORIC AIRFIELD IN THE ANDES?
DID EXTRATERRESTRIAL BEINGS HELP SET UP
THE GIANT STONE FACES THAT BROOD OVER EASTER ISLAND?
AND OTHER EARTH MYSTERIES UNANSWERABLE
UNTIL OUR OWN SPACE AGE!

Von Däniken did not invent the idea of ancient astronauts; it has its beginnings as far back as the nineteenth century. Also, in 1919, Charles Fort speculated in his *Book of the Damned* about archaeological indications for early extraterrestrial visitation. Such speculation was also common to pre–von Däniken saucer writers such as Morris K. Jessup (Clark 1998, 1: 75–86).

Nevertheless, von Däniken did create modern worldwide interest in the notion in his books. Again and again, however, he misrepresents the archaeological facts. For example, he suggests that the Egyptians could not have built the pyramids, that they lacked the means of quarrying the stones, transporting them (having neither rope nor wood for rollers), or lifting them in place (von Däniken 1971, 74–80). In fact, the quarries are still extant (one of them being the hollow area in which the Sphinx stands); the "nonexistent" rope is displayed in quantities in museums; the Egyptians left a drawing showing how they transported a colossal statue of many times greater weight than any pyramid stone using rope and a wooden sledge; and traces still exist of the great earthen ramps (progressively lengthened as necessary to lessen the steepness) that were used to raise the stones (Nickell 1995, 187–188).

Von Däniken again overstates the difficulty of making the famous Nazca lines and giant ground drawings that are etched across thirty miles of Peruvian desert. Lines and figures, he opines, could have been "built according to instructions from an aircraft" (von Däniken 1971, 17). In fact, using sticks and knotted cord, I twice recreated Nazca geoglyphs: the giant condor (in 1982 on a Kentucky landfill) and the great spider (in 2006 on a California ranch for filming by National Geographic Television). No flying saucer was required to make the figures, whose lines are believed to be used for ritual processions (Nickell 1983; 2012b, 121–125; Aveni 2000, 212–222).

As to the "chariots" in the title of von Däniken's first book, they refer to the fiery spaceships he imagines had landed anciently, witnessed by awed primitives. He sees the large drawings as "signals" and the longer and wider lines as "landing strips" (von Däniken 1971, 17; 1972, 105). However, Maria Reiche, the German-born mathe-


Pat Delgado & Colin Andrews
CIRCULAR EVIDENCE
A DETAILED INVESTIGATION OF THE FLATTENED SWIRLED CROPS PHENOMENON
The compelling, first-hand account by England's leading investigators of the crop circle enigma . . .

EXPOSED: Two artists admit they pulled off the great corn circles hoax for 13 years

MEN WHO CONNED THE WORLD

matician who mapped and studied the markings, had a ready rejoinder. Noting that the earth there is quite soft, she quipped, "I'm afraid the spacemen would have gotten stuck" (quoted in McIntyre 1975, 718).

DOUG BOWER AND DAVE CHORLEY: CROP CIRCLE MAKERS

As early as 1978, mysterious, swirled patterns began to appear in southern English fields—most often in wheat and other cereal crops, or "corn" as the British say. They inspired countless articles and a spate of books, no fewer than three in 1989. Circles-mystery enthusiasts were now called "cereologists" (after Ceres, the Roman goddess of vegetation), and "circlemania" was in full bloom (Nickell with Fischer 1992, 177–178).

The phenomenon was essentially new. An attempt to link it with a circle that had appeared in a field of oats in Hertfordshire in 1678—then attributed to witchcraft—fails because that circle was cut, not bent down in a swirled pattern. Although reports of such circles have surfaced in modern times, such as those of reeds in Australia in 1966 and a burned circle of grass in Connecticut in 1970, few had the flattened swirl feature and few were well documented at the time. All were supposedly suggestive of flying-saucer landing spots, such as circles shown in tall grass in a Swiss village by a man claiming to be regularly visited by extraterrestrials (Nickell with Fischer 1992, 183–184).

As investigation showed, several factors pointed to hoaxing as the most likely explanation: Suspiciously, crop circles were more prevalent in southern England, had proliferated as media reports increased, were becoming more complex each season, and exhibited a "shyness" effect (that is, the mechanism avoided being seen in operation). Then two retired artists—Doug Bower and Dave Chorley—confessed they had pioneered in the making of the patterns using planks and cord. They proved their ability by fooling cereologist Pat Delgado, who had declared a pattern they had produced for a British tabloid to be genuine. Soon, others came forward to admit that they too had made circles, helping it become a copycat phenomenon (Nickell with Fischer 1992, 177–210).

"Doug and Dave," as they became known, were not only the originators of the modern phenomenon, they kept at it and were responsible for many of the giant grain-field patterns made over the years. Although they wrote no articles or books, they demonstrated their circle-making technique for television crews—for example, for ABC-TV's *Good Morning America* (September 10, 1991)—and their proclaimed hoax gained worldwide publicity.

Those who did write the articles and books—and who therefore certainly helped promote the mystery of the phenomenon—were much less the "creators" of crop circles than they were its victims. Among them were Terence Meaden (author of *The Circles Effect and Its Mystery*, 1989), who had postulated that the crop circles were due to wind vortexes, but, as he kept modifying his theories to fit the evidence on the ground, the patterns continuously changed to keep one step ahead. Pat Delgado and Colin Andrews (authors of *Circular Evidence*, 1989, and other books) were major promoters, but they were fooled by Doug and Dave and their imitators, and, as other hoaxes were revealed, they were left foolishly holding their dowsing rods. Many other circles promoters were likewise fooled, but there were die-hards such as Eltjo H. Haselhoff, PhD (2001), who were undaunted by "self-proclaimed" hoaxers and soldiered on, as the circles became ever more elaborate, morphing into mathematical formations, pictograms, and even rectilinear designs that seemed a spoof of the very term "crop circles."

* * *

One wonders what these several "creators of the paranormal" would today think of what they had wrought. No doubt most felt their cause important. Some were credulous but principled (Bernard Heuvelmans and J.B. Rhine); some were out to make a buck (Harry Price, Vincent Gaddis, and Erich von Däniken); and still others wished to stir things up and enjoy the fray (Charles Fort, Raymond Palmer, and Doug Bower and Dave Chorley). Perhaps each was rewarded in his own way. Despite some side benefits (our learning more about such things as waking dreams, misperceptions, the will to believe, etc.) the paranormal has proved largely a chimera—that fire-breathing, lion-headed, goat-bodied, serpent-tailed monster of ancient mythology. Nevertheless, it still lurks at the common boundary of superstition and science, endlessly chasing its scorched tail. ■

References

Alcock, James E. 1996. Extrasensory perception. In Stein 1996, 241–254.

Aveni, Anthony F. 2000. *Nasca: Eighth Wonder of the World?* London: British Museum Press.

Brunvand, Jan Harold. 1996. *American Folklore: An Encyclopedia*. New York: Garland.

Clark, Jerome. 1992. *UFO Encounters*. Lincolnwood, Illinois: Publications International.

———. 1998. *The UFO Encyclopedia*, in two vols. Detroit, MI: Omnigraphics.

Coleman, Loren, and Jerome Clark. 1999. *Cryptozoology A to Z*. New York: Fireside.

Ebon, Martin. 1975. *The Riddle of the Bermuda Triangle*. Scarborough, Ontario, Canada: The New American Library of Canada.

Gaddis, Vincent. 1965. *Invisible Horizons: True Mysteries of the Sea*. New York: Chilton Books.

———. 1991. Interview by Mark Chorvinsky. *Strange Magazine* 7 (April): 14–18, 54–55.

Guiley, Rosemary Ellen. 2000. *The Encyclopedia of Ghosts and Spirits*. New York: Checkmark Books.

Hansel, C.E.M. 1966. *ESP: A Scientific Evaluation*. New York: Charles Scribner's Sons.

Haselhoff, Eltjo H. 2001. *The Deepening Complexity of Crop Circles*. Berkeley, CA: Frog, Ltd.

Is It Real? "Bermuda Triangle." 2006. National Geographic Channel, aired September 25.

Jones, E.V.W. 1950. Sea's puzzles still baffle men in pushbutton age. *Miami Herald* (September 17): 6F.

Keel, John A. 2001a. The man who invented flying saucers. *Fortean Times* 41 (Winter): 52–57.

———. 2001b. The Shaver mystery. In Story 2001, 536–546.

Knight, Damon. 1970. *Charles Fort: Prophet of the Unexplained*. Garden City, NY: Doubleday.

Kusche, Lawrence David. 1975. *The Bermuda Triangle Mystery—Solved*. New York: Warner Books.

———. 1996. The Bermuda Triangle. In Stein 1996.

———. 2015. The Bermuda Triangle mystery delusion: Looking back after forty years. Skeptical Inquirer 39(6) (November/December): 28–37.

Loxton, Daniel, and Donald R. Prothero. 2013. *Abominable Science! Origins of the Yeti, Nessie, and Other Famous Cryptids*. New York: Columbia University Press.

McGaha, James, and Joe Nickell. 2014. Mount Rainier: "Saucer magnet." Skeptical Inquirer 38(3) (May/June): 34–39.

McIntyre, Loren. 1975. Mystery of the ancient Nazca Lines. *National Geographic* (May).

Morris, Richard. 2006. *Harry Price: The Psychic Detective*. Stroud, Gloucestershire, UK: Sutton.

Nadis, Fred. 2013. *The Man from Mars: Ray Palmer's Amazing Pulp Journey*. New York: Tarcher/Penguin.

Nickell, Joe. 1983. The Nazca drawings revisited. Skeptical Inquirer 7(3) (Spring): 36–44.

———. 1995. *Entities: Angels, Spirits, Demons and Other Alien Beings*. Amherst, NY: Prometheus Books.

———. 2004. *The Mystery Chronicles*. Lexington: University Press of Kentucky.

———. 2007. The Bermuda Triangle and the 'Hutchinson Effect.' *Skeptical Briefs* (September): 5–7.

———. 2011. *Tracking the Man-Beasts*. Amherst, NY: Prometheus Books.

———. 2012a. *The Science of Ghosts*. Amherst, NY: Prometheus Books.

———. 2012b. *CSI Paranormal*. Amherst, NY: Inquiry Press.

———. 2013a. Scotland mysteries—part 1: The silly Ness monster. Skeptical Inquirer 37(2) (March/April): 20–22.

———. 2013b. Bigfoot lookalikes. Skeptical Inquirer 37(5) (September/October): 12–15.

———. 2014. Era of the flying saucers. Skeptical Inquirer 38(6) (November/December): 16–18.

Nickell, Joe, with John F. Fischer. 1992. *Mysterious Realms*. Amherst, NY: Prometheus Books.

Price, Harry. 1936. *Confessions of a Ghost Hunter*. London: Putnam.

———. 1940. *The Most Haunted House in England: Ten Years' Investigation of Borley Rectory*. London: Longmans Green.

Sachs, Margaret. 1980. *The UFO Encyclopedia*. New York: Perigee Books.

Sanderson, Ivan. 1975. World-wide seas of mystery. In Ebon 1975.

Sands, George X. 1952. Sea mystery at our back door. *Fate* (October): 11–17.

Stein, Gordon, ed. 1996. *The Encyclopedia of the Paranormal*. Amherst, NY: Prometheus Books.

Steinmeyer, Jim. 2008. *Charles Fort: The Man Who Invented the Supernatural*. New York: Tarcher/Penguin.

Story, Ronald D., ed. 2001. *The Encyclopedia of Extraterrestrial Encounters*. New York: New American Library.

Von Däniken, Erich. 1971. *Chariots of the Gods?* New York: Bantam.

———. 1972. *Gods from Outer Space*. New York: Bantam.

Joe Nickell, CSI's senior research fellow, is one of the world's leading investigators into claims of the paranormal. His many books include *Adventures in Paranormal Investigation*, *The Real-Life X-Files*, *The Science of Ghosts*, *Tracking the Man-Beasts*, and *The Mystery Chronicles*.

Dissociation and Paranormal Beliefs

Toward a Taxonomy of Belief in the Unreal

In a normal population, dissociative tendencies contribute to many types of paranormal thinking. Psychological dissociation, even at a subclinical level, is an important factor in the cognitive processing that leads to belief in the unreal.

MATTHEW J. SHARPS, SCHUYLER W. LIAO, AND MEGAN R. HERRERA

Virtually all known human cultures possess beliefs in the paranormal. This may at first seem maladaptive—how could belief in the unreal be sufficiently advantageous that it would have survived the rigors of human evolution in the all-too-real world of past ages?

Such beliefs may have yielded evolutionary advantages. Although the interaction of culture and human evolution is complex, it is certainly possible that shared paranormal beliefs within any given culture, such as shared veneration of ancestral spirits or god-kings, might have yielded a coalescent group loyalty that would be useful, physically and politically, in dealings with other competing cultures. This might very well have resulted in a selective bias toward dissociative processes, leading to success in those cultures that indulge in such beliefs.

But even if this is the case, a significant psychological question arises—one especially true for the modern world, in which access to scientific information is effectively unparalleled historically—How are such beliefs maintained in the minds of *individuals*, within any given culture? Why do individual people harbor bizarre beliefs?

Experimental Psychology and the Paranormal

Previous laboratory research has demonstrated the importance of psychological characteristics that predispose individuals to paranormal thinking. In earlier research (Sharps et al. 2006; 2010), we showed that subclinical levels of depression were important for belief in ghosts and extraterrestrial aliens. This is presumably because the depressed would prefer to be in an environment where things might be better; and things might be better in the afterlife represented by ghosts, or perhaps on another, nicer planet where extraterrestrials might live.

Subclinical tendencies toward attention deficit hyperactive disorder (ADHD) predisposed people to belief in extraterrestrial aliens and cryptids such as Bigfoot and the Loch Ness monster. Why? Aliens and monsters are *cool*, and finding them in the woods and bodies of water takes us away from the mundane reality that those with ADHD tendencies frequently find excruciatingly dull.

However, in these studies, the most important of the characteristics predisposing us to paranormal thinking was *dissociation*. Not only did subclinical levels of dissociation predispose people to beliefs in *everything* paranormal (whether UFOs, aliens, cryptids, or ghosts), but it *also predisposed them to see these things*. In a study in which we used Internet pictures of "paranormal" creatures and objects (Sharps 2012), the dissociated tended to see them as real. Where everybody else saw a teenager in a Halloween gorilla suit with extra monkey hair, those with subclinical dissociation saw Bigfoot. Odd lights in the sky (a helicopter with a broken landing light, for example) readily became UFOs for the dissociated. In short, those with subclinical dissociation tended to see the prosaic as real evidence of the paranormal.

It is crucial to emphasize the word *subclinical*. People with dissociative characteristics are emphatically not "crazy." All human beings experience some levels of dissociation in their everyday life without clinical significance. But those with more of these tendencies tend to see their world in vastly more paranormal terms. They not only *believe* in these things; they *see* them in stimuli that other people would immediately perceive as nonparanormal in nature.

Subclinical dissociation was also important in the 2012 Mayan "end of the world" fiasco, in which an ancient Mayan god was (depending on which interpretation you believed) literally expected to surf ashore on a raft of very old (but presumably waterproof) sacred snakes and establish a New Order of peace and so forth.

Not terribly likely, right?

We were privileged to publish two articles in the Skeptical Inquirer (Sharps et al. 2013; 2014) concerning the psychological factors that made it possible for modern human beings to believe in this type of baseless nonsense. We found that disturbingly high numbers of university students held very incoherent, but very positive, beliefs in the "Mayan end of the world." Almost half of our research respondents thought it might happen; 10 percent were effectively certain that it was going to happen, and 10 percent thought it was still inevitable *even after it didn't happen*. When one considers the requisite physical details (Mayan god, waterproof snakes, etc.), one rather wonders what these students, exposed on a daily basis to modern science, were majoring in. Yet they bought it, and the number one factor producing this deeply bizarre set of beliefs was subclinical dissociation.

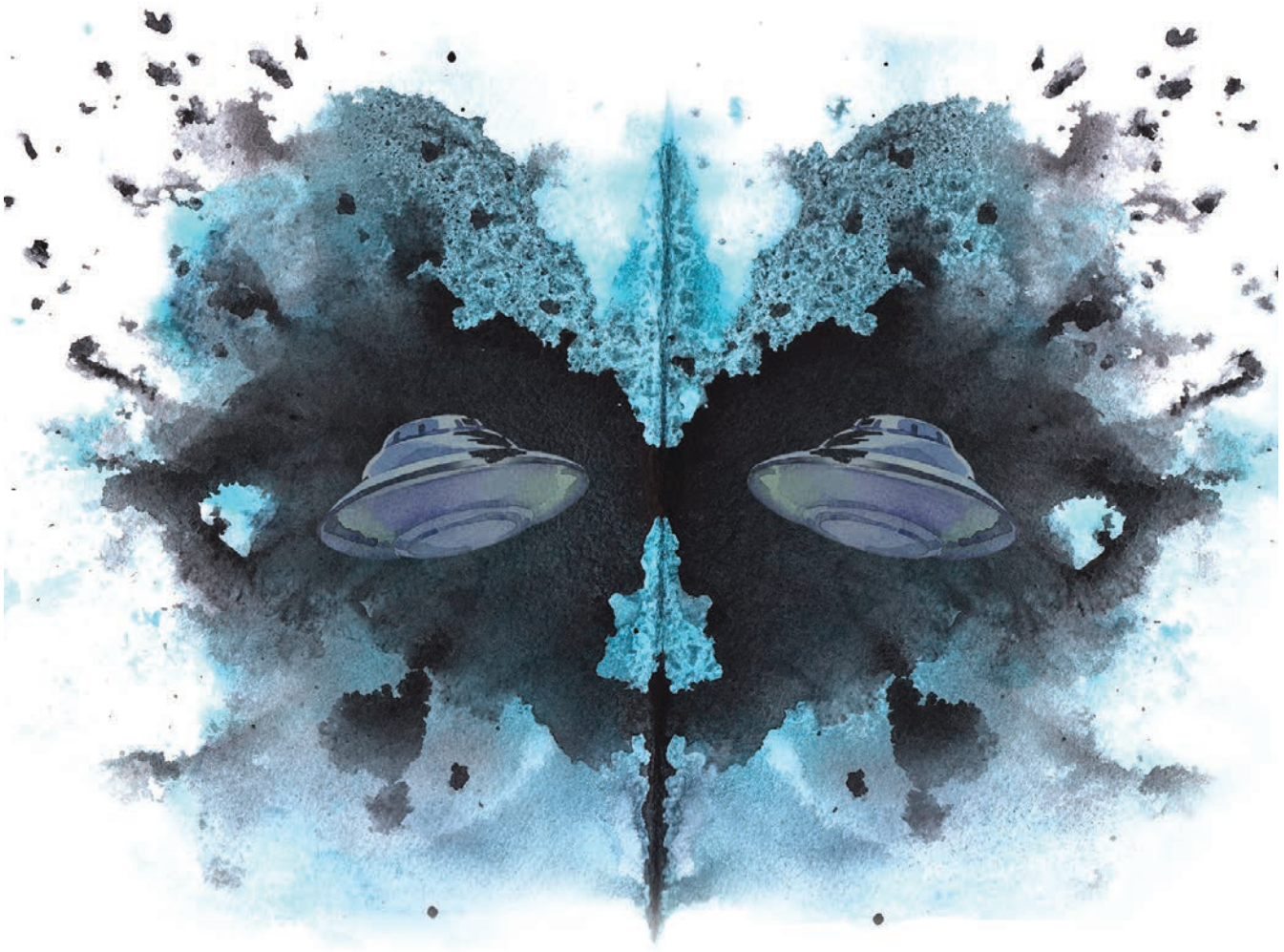
What Exactly *Is* Dissociation?

Unfortunately, the term *dissociation* has many uses and definitions. In our usage, we emphatically do not refer to psychiatric concepts of dissociative identity disorder, or to a psychotic level of dissociation. We refer to *subclinical* dissociative tendencies, of the sort probably experienced from time to time by most people. Those with subclinical dissociative tendencies see prosaic reality as potentially fraught with supernatural meaning. For the dissociated, the facades of buildings, seen in everyday context on the street, might hide vast conspiracies or alien autopsies or Bigfoot.

This type of dissociation may lead to a diminished critical assessment of reality; as discussed in earlier Skeptical Inquirer articles (Sharps 2012; Sharps et al. 2013; 2014), there may be anomalous perceptions of individual experience. The world may appear to be "not quite real or . . . diffuse" (Cardena 1997, 400). This is emphatically *not* "mental illness." However, the disconnection with immediate physical reality that occurs with subclinical dissociation might incline many normal people to view highly improbable things with more credulity (see DePrince and Freyd 1999; also Sharps et al. 2013; 2014).

Compulsory education does not cure this sort of thing. College students frequently engage in superstitious or "lucky" behaviors when approaching examinations and tests in their classes, especially when the consequences are perceived as particularly important (Rudski and Edwards 2007). Almost half of our college students (Sharps et al. 2013; 2014) thought that the Mayan apocalypse might happen, and 10 percent were sure that it would.

So, we know that dissociation con-



tributes to paranormal beliefs and perceptions. But how pervasive is it? What types of paranormal thinking and perception are associated with dissociative tendencies?

This was the focus of our present study, which used standardized instruments to address the question.

Experimental Framework

Forty-one male respondents (mean age 19.37 years, SD = 1.73) and sixty-three female respondents (mean age 19.21 years, SD = 1.37) participated in this study. These respondents completed the Dissociative Experiences Scale (DES; Carlson and Putnam 1986). This is a standard instrument for the assessment of dissociative tendencies, used previously in a number of our experiments, including those published in the Skeptical Inquirer (e.g., Sharps 2012; Sharps et al. 2013; 2014). The DES deals with empirically verified everyday experiences that relate strongly to dissociation, the focus of the current research.

So, we know that dissociation contributes to paranormal beliefs and perceptions. But how pervasive is it? What types of paranormal thinking and perception are associated with dissociative tendencies?

The respondents also completed the Revised Paranormal Belief Scale (RPBS; Tobacyk 2004). This scale addresses paranormal beliefs of various types, addressing beliefs in such areas as the soul, magic, and cryptids. This standardized instrument addresses, on an empirical basis, many of the paranormal beliefs current in Western culture.

Finally, respondents completed the standard Duke University Religion Index (e.g., Koenig and Bussing 2010), which deals with religious *behaviors* related to the supernatural (e.g., church attendance).

The items of the RPBS were sorted according to their subject areas. The twenty-six items of this scale were sorted into the following indices: beliefs in Religiosity, Magic, Luck, Future Prediction, Cryptids (i.e., the Loch Ness monster), Fate of the Soul, and Supernatural Powers. The overall score on the RPBS, and the score of each respondent on each of these beliefs, was computed and compared with scores on the DES, and then on the Duke Index, by means of linear regression. The results were quite revealing.

Results

The relationship of overall scores on the RPBS to dissociation in this non-diagnosed, normal population was significant (linear regression), $R^2 = .171$, $F(1,101) = 21.70$, $p < .001$, $\beta = .423$. Especially interesting is the fact that *all* factors identified as paranormal were significantly ($p < .05$) related to dissociation as measured by the DES. In other words, tendencies toward subclinical dissociation, in this normal, non-diagnosed population, were *strongly* related to all forms of paranormal beliefs.

In terms of relationship to subclinical dissociation, Religiosity was most strongly related by beliefs in heaven and hell ($\beta = .281$). Magic was most strongly endorsed by beliefs in witchcraft ($\beta = .167$), although beliefs in specific cases of witchcraft was another matter; see below. Luck was most strongly endorsed by a fear of black cats ($\beta = .268$). Future Prediction was most strongly endorsed by a belief in astrology ($\beta = .270$). (Belief in cryptids, for this scale, dealt only with the Abominable Snowman and the Loch Ness monster; Bigfoot and his allies were conspicuously absent from this instrument). Nessie was strongly endorsed, $\beta = .420$, while the Snowman was not. We address this important dichotomy below.

Fate of the Soul was most strongly supported by belief in the possibility of communication with the dead ($\beta = .185$), with belief in reincarnation a close second ($\beta = .164$). Belief in astral projection fell a distant third, $\beta = .064$. Finally, psychic powers were endorsed most strongly in mental "object moving," $\beta = .224$, although psychokinesis, effectively a synonym, was endorsed less strongly ($\beta = .109$; see below).

Two additional items of the RPBS tested DES scores against modern scientific perspectives. The first, a belief that "mind reading cannot occur," was nonsignificant against dissociative tendencies. However, the second, that there may be life on other planets, was endorsed more strongly and significantly by the dissociated, $\beta = .231$.

Interestingly, *no* significant relationship was found between dissociation and the scales of the Duke University Religion Index, which at first appears to conflict with the significant relationship of the DES to the Religiosity scale of the RPBS; but wait.

Discussion

Dissociation, as measured in this subclinical population by the DES, was significantly associated with *every index of paranormal thinking measured*. Those with dissociative tendencies were more likely to believe in heaven/hell, witchcraft, the danger of black cats, astrology, the Loch Ness monster, communication with the dead, reincarnation, and psychic powers.

However, belief in the Abominable Snowman, specific instances of witchcraft, and psychokinesis were not as strongly related to dissociative tendencies. Why not?

Gestalt and Feature-Intensive Processes

Previously (Sharps 2003; 2010; Sharps et al. 2013; Sharps and Nunes 2002), we presented a continuum in human information processing, in what is called the Gestalt/Feature-Intensive Processing theory. This continuum ranges from *feature-intensive* processing, in which the specific details of a concept are given specific consideration in depth, to *gestalt* processing, in which a given concept is considered without detailed analysis, with relatively uncrit-

ical acceptance of the given idea as a whole.

We suggest here a relationship between *dissociative tendencies* and *gestalt processing*, the relatively uncritical, detail-free consideration of given phenomena. In 2012, enormous attention was given to the Maya prophecies in media and in other sources. This, according to the *availability heuristic* of Tversky and Kahneman (1973), made these prophecies relatively salient to the entire population. These prophecies were relatively available, to everybody, in various media sources and were therefore immediately salient for people thinking about these issues.

However, for most people, there would have been some *feature-intensive* consideration of these prophecies; feature-intensive analysis tells us that ancient societies, such as the Mayans, lacked modern scientific understanding, and so their prophecies might not be right. Also, a serious, feature-intensive consideration of an ancient Mayan god surfing ashore on a raft of long-suffering, six-hundred-year-old waterproof snakes becomes immediately ridiculous.

However, those exhibiting subclinical levels of dissociation, *with consequent gestalt processing tendencies*, would not engage in the necessary feature-intensive thinking; they would not think about the time involved, or the snakes, and would thereby credulously entertain the Mayan "prophecies." In our previous research (Sharps et al. 2013; 2014), that's exactly what they did. The ludicrous, feature-intensive details would be lost in favor of a *gestalt*, an idea something like "the god will return." This gestalt processing would necessarily result in a consequent strength of belief in a god-ridden "New Age," without the bothersome concerns engendered by feature-intensive, scientific, appropriately skeptical analysis.

These considerations are underscored by the exceptions to this pattern we noted earlier. More dissociated individuals believed in the Loch Ness monster than in the Abominable Snowman. Why?

The Snowman is little seen today in televised and Internet accounts, taking a decided backseat to Bigfoot and his cronies. The Abominable Snowman is historically an earlier concept, less "available" to modern thinking in Tversky and Kahneman's terms. Thinking about this older concept would require more feature-intensive concepts to consider, more in-depth thinking about a relatively unfamiliar idea.

The Loch Ness monster, on the other hand, is seen in TV "documentaries" all the time. Even with its historical provenance, it is therefore a modern concept, relatively "available" in Tversky and Kahneman's terms, more amenable to modern thinkers, and hence more readily processed in gestalt, feature-free terms. Therefore, the dissociated tend to endorse Nessie relatively freely. The Snowman takes more work, more feature-intensive analysis, and is therefore less readily endorsed.

We saw the same effect with astrology and astral projection. Astrology is a still-current, relatively available concept, requiring little feature-intensive analysis. Astral projection, a concept whose televised and Internet popularity has waned, would require more feature-intensive analysis, and would require less detail-free gestalt consideration for easy acceptance.

The same effect applies to "object moving" and "psychokinesis." Mental object moving requires no analysis at a feature-intensive level; it is eponymous. "Psychokinesis," although effectively a synonym for "mental object moving," is an earlier, currently less available concept, which requires additional thought, activating feature-intensive processing. Thus, mental "object moving" was endorsed with its automatized, eponymously gestalt characteristics, whereas the more feature-intensive, but synonymous, concept of psychokinesis was not.

Finally, the same phenomenon was observed in the endorsement of "witchcraft" as a general, gestalt phenomenon, but in the absence of statistically significant endorsement of specific *instances* of witchcraft, which would require more feature-intensive thinking. The general phenomenon was endorsed; the specific instances were not.

From all of these instances, the pattern is clear: when broad, noncritical gestalt processes are involved, the dissociated tend more toward paranormal beliefs. When analytical, skeptical, feature-intensive processes are required, paranormal beliefs recede, at least to some degree.

When broad, noncritical gestalt processes are involved, the dissociated tend more toward paranormal beliefs. When analytical, skeptical, feature-intensive processes are required, paranormal beliefs recede, at least to some degree.

What about the Duke Religion Index?

No significant relationships were found between dissociative tendencies and the scales of the Duke Index. Is this an exception to the considerations discussed above?

The answer is no, although this situation opens important avenues for future research. The Duke scales predominantly assess religious *activities*, not *beliefs*. This index addresses tendencies to engage in church attendance and related activities rather than specific ideas about theological phenomena.

Church attendance and such are precisely the activities that would have allowed one to adhere to local standards in the vastly more religious ancient world. Whether you believe or not, these activities allow you to insert yourself more firmly into a religious community, a crucial factor in the tribal societies of the ancient world.

Human evolution has fostered the tendency to fit into society. Ancient societies, those in existence through the majority of human evolutionary time, tended to hold specific sets of beliefs. If you demonstrated your beliefs accordingly, you were accepted; if not, you were ostracized, frequently with fatal consequences.

The potential adaptive significance, the evolutionary advantage, is obvious. In any given ancient society, as long as you demonstrated your beliefs, regardless of internal cognitive processes, you were an acceptable member of the society. If you did not do so, you were ostracized or killed.

Thus, we see a potentially important dichotomy between actual gestalt and feature-intensive beliefs, and a demonstration of the importance of apparent conformation to these beliefs in socially acceptable venues. Those who engaged in the appropriate religious rituals were most likely to succeed in most of the societies that preceded the modern era. Those who did not were ostracized or killed. This was true regardless of the internal cognitive processes of thinking or belief.

Therefore, religious activities, as opposed to beliefs and as measured by the Duke Index, would not be expected to be influenced, substantially or significantly, by subclinical dissociative tendencies. The more successful, less dissociative individuals would historically be suggested to have engaged in religious activities to the same degree as everybody else, and we would anticipate this tendency to have continued into the modern world. However, the *beliefs* involved would be more likely to be endorsed by the dissociated; that is exactly what was demonstrated by the present results.

In summary, our present results indicate:

1. Subclinical dissociative tendencies predispose people to paranormal beliefs.
2. Those paranormal systems that require only gestalt cognition are more likely to result in the endorsement of such beliefs, as opposed to those that require more intense, feature-intensive thinking, which do not.
3. These dynamics are more likely to be observed in the realm of paranormal or religious *thinking* rather than in the realm of locally approved *activities* (e.g., church attendance).

The best way to counter such paranormal beliefs is to make use of educational interventions that involve feature-intensive analysis and thinking. Potential believers in paranormal phenomena are most likely to question these erroneous beliefs if provided with solid, feature-intensive educational environments in which they must confront such supposed phenomena as extraterrestrial aliens, cryptids, and ghosts in very specific terms.

Summary

Our latest research shows that those who exhibit subclinical tendencies toward paranormal beliefs also tend toward subclinical dissociation. These tendencies may best be countered by detail-specific, feature-intensive, scientific education. Hopefully, these considerations may inform education at the primary, secondary, and collegiate levels to reduce paranormal beliefs in favor of scientifically legitimate thinking needed to develop realistic science and technology. ■

References

Cardena, E. 1997. Dissociative disorders: Phantoms of the self. In S.M. Turner and M. Hersen, eds., *Adult Psychopathology and Diagnosis*, third edition, 400. New York: Wiley.

Carlson, E.B., and F.W. Putnam. 1986. Development, reliability, and validity of a dissociation scale. *Journal of Nervous and Mental Disorders* 174: 727–735.

DePrince, A.P., and J.F. Freyd. 1999. Dissociative tendencies, attention, and memory. *Psychological Science* 10(5): 449–452.

Koenig, H.G., and A. Bussing. 2010. The Duke University Religion Index: A five-item measure for use in epidemiological studies. *Religions* 1(1): 78–85.

Rudski, J.M., and A. Edwards. 2007. Malinowski goes to college: Factors influencing students' use of ritual and superstition. *Journal of General Psychology* 134: 389–403.

Sharps, M.J. 2003. *Aging, Representation, and Thought: Gestalt and Feature-Intensive Processing*. Piscataway, NJ: Transaction.

———. 2010. *Processing Under Pressure: Stress, Memory, and Decision-Making in Law Enforcement.* Flushing, NY: Looseleaf Law.

———. 2012. Eyewitness to the paranormal: The experimental psychology of the "unexplained." Skeptical Inquirer 36(4): 39–45.

Sharps, M.J., S.W. Liao, and M.R. Herrera. 2013. It's the end of the world, and they don't feel fine: The psychology of December 21, 2012. Skeptical Inquirer 37(1): 34–39.

———. 2014. Remembrance of apocalypse past. Skeptical Inquirer 38(6): 54–58.

Sharps, M.J., J. Matthews, and J. Asten. 2006. Cognition, affect, and beliefs in paranormal phenomena: Gestalt/feature intensive processing theory and tendencies toward ADHD, depression, and dissociation. *Journal of Psychology* 140(6): 579–590.

Sharps, M.J., E. Newborg, S. Van Arsdall, et al. 2010. Paranormal encounters as eyewitness phenomena: Psychological determinants of atypical perceptual interpretations. *Current Psychology* 29(4): 320–327.

Sharps, M.J., and M.A. Nunes. 2002. Gestalt and feature-intensive processing: Toward a unified theory of human information processing. *Current Psychology* 21(1): 68–84.

Tobacyk, J.J. 2004. A revised paranormal belief scale. *International Journal of Transpersonal Studies* 23(1): 94–98.

Tversky, A., and D. Kahneman. 1973. Availability: A heuristic for judging frequency and probability. *Cognitive Psychology* 5(2): 207–232.

Matthew J. Sharps is professor of psychology at California State University, Fresno, California, and serves on the adjunct faculty of Alliant International University in psychology. He specializes in eyewitness phenomena and related areas in forensic cognitive science. He is a diplomate and fellow of the American College of Forensic Examiners and is author of more than 180 publications and professional papers, including the 2010 book *Processing Under Pressure: Stress, Memory, and Decision-Making in Law Enforcement* (www.LooseleafLaw.com; 2nd edition in preparation, 2016). He has consulted on eyewitness issues in numerous criminal cases.

Schuyler W. Liao teaches cognitive and abnormal psychology at California State University and serves on the adjunct faculty of Fresno City College. His research focuses on the interaction of cognitive and affective processes in forensic psychology.

Megan R. Herrera is a doctoral candidate in forensic clinical psychology at Alliant International University, Fresno. Her research focuses on the interaction of cognitive, affective, and perceptual processes in forensic psychology.

Scientific Reasoning at the USAF Academy: An Examination into Titanium-Treated Necklaces

We used a classroom experiment at the United States Air Force Academy to examine whether necklaces infused with microscopic-particle titanium, such as those sold by Phiten Corporation, improve emotional well-being.

CRAIG A. FOSTER, CHRISTOPHER K. MCCLERNON, AND RICHARD F. REICH

Wedding bands typically feature a particular metal such as gold, silver, platinum, or in some cases, titanium. There is no scientific reason to believe that the substance of the metal (e.g., the titanium) has any direct influence on a person's physical health or emotional well-being. Now, imagine dissolving that same metal in water so the resulting microscopic-sized particles could be infused into an item that could be worn or kept in close proximity. Would the resulting item provide a health benefit where the solid mass could not?

That is the essence of the claim made by Phiten Corporation (Phiten), a Japanese company that distributes products worldwide. Phiten offered the following summary on the English version of its corporate webpage (see www.phiten.com):

> All Phiten products incorporate a novel form of technology that involves metals broken down into microscopic particles dispersed in water. This process underlines [*sic*] the technologies of a variety of unique materials we possess. By utilizing the property of each material to a maximum extent, we are able to realize customers' potentials in a variety of extents that leads to restore normal relaxation status of customers. This is the technology that supports more comfortable daily life.

These "Aqua Metals" include titanium, silver, platinum, palladium, and gold. They are incorporated into several products such as necklaces, bracelets, tape, lotions, athletic supports, garments, sleeping goods, and "relaxation equipment." Phiten also offers a "Phiten Room" where microscopic-particle titanium (MPT) can be permeated into wall surfaces to enhance relaxation.

Those who are not familiar with Phiten might be surprised at the popularity of its products. The Phiten webpage currently offers a robust list of global contacts that, at present, includes locations in Europe, Asia, Australia, North America, and South America. The United States subsidiary, Phiten USA (www.phitenUSA.com), notes that there are over 130 Phiten retail locations in Japan and that Phiten started officially in Southern California in 1998. The Phiten USA timeline also refers to several well-known athletes who have served as Phiten representatives (including Jennie Finch, Carmelo Anthony, Josh Hamilton, and Hideki Matsuyama). Phiten was a corporate partner of University of Hawaii Athletics for several years and has had formal relationships with Major League Baseball (MLB), the National Basketball Association (NBA), and the National Hockey League (NHL). Phiten recently developed a baseball cleat with New Balance, a well-known athletic apparel company. Phiten's products usually incorporate MPT, which is sometimes called "Aqua Titan" or "Aqua-Titanium." Phiten's titanium-treated necklaces seem to be particularly popular in baseball.

Claims and Evidence Surrounding MPT

We were interested in the claim that MPT, even when located externally to a person, can influence emotional well-being (e.g., wearing an MPT-infused necklace). The presence of MPT could influence well-being through a placebo effect, and MPT, when infused in a tape or garment, could exert some influence simply by keeping people warmer (see Rowlands et al. 2014). However, Phiten has clearly cultivated the notion that being in the presence of MPT can directly improve emotional well-being through some mysterious process. Consider Phiten's description regarding its necklaces and bracelets:

> Simply by wearing these products, your body can feel relaxed and refreshed. Our necklaces are an indispensable item for relieving stress and fatigue in our modern lives. . . . In all aspects of life—from everyday activities to athletics—our products can help maximize your potential energy and strength. This is why so many top athletes use Phiten products. (http://www.phiten.com/english/products/index.html)

Support for the theory that externally located MPT influences emotional well-being can be linked to two sources. The first is people who claim that MPT-treated products provide this benefit; if at least some of the reviews on Amazon.com are to be trusted, many people believe that Phiten necklaces alleviate pain or influence emotional well-being. The second source of support comes from a small number of publications promoting the potential health benefits of MPT. The Aoi et al. (2012) examination into the influence of MPT-treated surroundings provides the clearest implication that the external presence of MPT somehow influences emotional well-being. Aoi et al. randomly assigned office workers to sleep for five nights in quarters where the walls and floors were or were not infused with MPT. According to Aoi et al., their results "suggest that sleeping in a room containing titanium lowers physiological and psychological stress" (2012, p. 13).

Microscopic-particle titanium appears similar to other externally worn accessories with health-related claims that science generally deems as pseudoscientific: crystals, copper bracelets, and magnetic bracelets.

There are several reasons to be skeptical of this type of claim. One cause for concern is that research supporting the potential benefits of MPT is typically funded by Phiten, has an author who lists Phiten as the institutional affiliation, or both. The only exception was one article where the authors declared that there was no conflict of interest. This type of collaboration is not by itself improper, but it is possible that this corporate-research synergy could generate collectively biased results. Phiten-supported researchers might be less aggressive in publishing unflattering results, possibly creating a "file drawer problem." They might also knowingly or unknowingly overlook potential problems in their research methodologies. At the very least, it seems fair to suggest that the scientific community will have difficulty embracing the purported benefits of MPT without support from researchers who are clearly independent from Phiten.

Another concern is that Phiten's promotion of MPT and other Aqua Metals simply sounds like pseudoscience. The term *pseudoscience* can be used unfairly, so let us offer specific examples. First, support for Phiten's products is largely anecdotal (Shermer 2002). Second, there is no clear mechanism to explain how one variable influences another (see Thagard 1993), and even Phiten-funded researchers report that the mechanism between MPT and improved health "remains unclear" (Aoi et al. 2012, p. 17). Third, the variety of purported benefits associated with MPT might resemble pseudoscience in terms of sounding extraordinary (e.g., Hines 2003). Even the single implication that MPT can diminish the ever-present problem of stress would likely be the psychological discovery of the decade. Fourth, the theory that externally located MPT provides benefits appears to be constructed so that it can only be confirmed (e.g., Hansson 2013). This seems evident in the small necklace packaging disclaimer that states, "Not all users will experience the intended benefits of Phiten products, and individuals must try it for themselves to see whether it works for them." This disclaimer suggests that positive results can be attributed to the necklaces while negative results cannot. Fifth, MPT appears similar to other externally worn accessories with health-related claims that science generally deems as pseudoscientific: crystals, copper bracelets, and magnetic bracelets.

Classroom Experiment: Phiten Necklaces versus All-Purpose Clothesline

We examined the potential influence of Phiten necklaces in a United States Air Force Academy (USAFA) classroom experiment. We needed an experiment with two groups to create a subsequent demonstration of inferential statistics for pedagogical purposes. Our deeper motive was to support the USAFA Officer Development mission by reinforcing the intertwined values of empiricism and scientific reasoning. Military professionals should value empiricism to prevent the military from investing in products and services that do not provide any real benefit. Military professionals should also learn to supplement intuition, when possible, with well-reasoned evidence. This is seen perhaps most dramatically among pilots. When the experience of in-cockpit flight disrupts the vestibular system, pilots can experience

a psychologically powerful motivation to navigate based on their dysfunctional perception, possibly resulting in fatal impact. Pilots are therefore trained to rely on decades of accumulated evidence demonstrating that they should at these moments "trust their instruments" and navigate in a manner that feels tremendously dangerous. This interplay between intuition and science also occurs in other areas. Officers can manage in ways that feel correct but stand in contrast to empirically supported theories. Officers presumably benefit from considering evidenced-based theories regarding effective peace support or wartime operations to facilitate their own situation-based judgment. Our impression was that cadets value empiricism and scientific reasoning as textbook definitions but overlook these values in everyday application. We therefore designed a classroom experiment that would allow cadets to experience an examination into a seemingly outlandish claim rather than just read about it.

We asked cadets who were in the second semester of a year-long course sequence about statistics and research methods in the behavioral sciences to participate. These cadets were typically in their third year at the USAFA. Cadets were not required to participate, and a small percentage of cadets declined participating. Forty-eight USAFA cadets (thirty-three female, fifteen male) chose to participate.

An instructor (Foster) told participating and non-participating cadets that we wanted to examine products that reportedly improve personal well-being. He explained that the research involved wearing necklaces that were covered in tape to conceal their nature. Cadets were asked to wear the necklaces until the next class meeting, which occurred forty-eight hours later. Cadets were instructed, for safety purposes, not to wear their respective necklaces when sleeping but to instead wrap them around a wrist, put them under a pillow, or place them next to their person. The instructor also acknowledged that some of them might need to remove the necklaces temporarily (e.g., for athletic practices or showering) and, if this were the case, to document when this was necessary. Finally, the instructor encouraged cadets to participate fully and seriously in order to support the scientific process and overall learning experience.

Cadets were then presented sequentially with a large bin from which they could remove a tape-covered necklace. The bin contained a mixed assortment of two different necklaces. Half of the included necklaces were Phiten's Classic Titanium Necklaces (in orange or burnt orange) purchased using the Phiten USA webpage (Phiten Condition). The other necklaces were segments of Everbilt's 3/16 Inch All-Purpose Clothesline in White (Clothesline Condition) purchased from The Home Depot. We chose the clothesline because it closely approximated the size and weight of the Phiten necklaces. We removed the clasps from the Phiten necklaces to create straight twenty-six-inch segments. We cut the pieces of clothesline to be the same length. We then wrapped all necklaces in masking tape and connected the ends by wrapping that portion of the necklace with white Duct Tape (see Figure 1 where one cadet is wearing a Phiten necklace and the other a "Clothesline" necklace). It is quite unlikely that any cadet would attempt to identify a necklace due to concerns about honor and simply being busy. The uncommon white duct tape was nonetheless used as an additional safeguard to discourage any cadet who might be tempted to remove it to identify his or her necklace. Finally, it is important to note that we judged the necklaces to be exceptionally similar in appearance and feel, and we are certain that they created an effective double-blind study—the cadets did not know what kind of necklace they were wearing, and the class instructors could not tell either. Some cadets might have suspected that there was more than one kind of necklace, but we doubt they were overly concerned in this regard.

Figure 1. Two cadets wearing the necklaces used in the experiment. It is impossible to tell which one is sporting the Phiten necklace.

Cadets completed a survey at the next class meeting, which created an experimental trial of approximately forty-eight hours. The survey began with three questions: Do you feel relaxed? Do you feel angry? Do you feel ener-

In sum, we believe that our classroom experiment provided a legitimate conceptual replication of the research provided by Aoi et al.

getic? We used these three dependent variables based on the claims associated with necklaces and bracelets on the Phiten webpage as well as the results provided by Aoi et al. (2012). Each item was followed by a scale ranging from 1 (No) to 9 (Yes). The survey also solicited which class section cadets were in (there were three sections), their sex, and whether they knew what type of necklace they were wearing (none reported knowing). Finally, the survey asked cadets to document any time that they had removed the necklaces other than when showering or when sleeping (at which time it should have been next to their person). We revealed the nature of the experiment and a corresponding laboratory assignment after the survey responses were collected.[1]

Results

Cadets in the Phiten Condition reported feeling trivially less *Relaxed* (*M*=5.62, *SD*=2.02) than did cadets in the Clothesline Condition (*M*=5.67; *SD*=1.99). Cadets in the Phiten Condition reported feeling less *Angry* (*M*=2.12; *SD*=1.42) than did cadets in the Clothesline Condition (*M*=2.71; *SD*=1.88). Cadets in the Phiten Condition reported feeling less *Energetic* (*M*=4.96; *SD*=2.05) than did cadets in the Clothesline Condition (*M*=5.46; *SD*=1.59). We conducted independent samples *t* tests comparing the Phiten Condition and the Clothesline Condition for each dependent variable. None of the three results revealed differences between the conditions that would be deemed as statistically significant at the standard expected in the behavioral sciences (i.e., all three tests had corresponding probability values greater than 0.05). To be additionally mindful, we identified three subsets of participating cadets based on their survey responses: (a) three cadets who wrote that they had been ill during the trial (one in the Phiten Condition); (b) one cadet who forgot to wear the necklace on the final morning and therefore completed the survey without it (Clothesline Condition); and (c) six other cadets who appeared to have spent more than eight hours without wearing their necklace or having it next to them while sleeping (one in the Phiten Condition). We repeated the comparisons between the Phiten and Clothesline Conditions after omitting all possible combinations of these three subjects. The obtained results again did not reveal any statistically significant differences between conditions.

Implications

The results of our classroom-based experiment do not by themselves fundamentally disprove the notion that externally located MPT puzzlingly promotes emotional well-being. Failing to detect a relationship between an independent variable and a dependent variable does not mean the relationship does not exist; it just means the researcher was unable to detect it. After all, USAFA cadets, like all people, experience situational factors that could influence their levels of relaxation, anger, and energy (e.g., academic responsibilities, required or voluntary exercise, interpersonal concerns, sleep deprivation, and so forth). This type of random error is omnipresent in research with human participants, so it does not invalidate our research. Nevertheless, in the spirit of good science, we do need to acknowledge that *if* MPT necklaces were to influence emotional well-being, it is possible that these extraneous influences could have hidden that effect.

Those who believe in the power of externally located MPT might examine the tangible differences between our experiment and the Aoi et al. (2012) experiment. The MPT-treated surroundings surely contained greater amounts of MPT, but our necklaces were presumably in closer proximity to the participants' bodies. We assume that MPT proponents would agree that proximity must matter; otherwise MPT-treated necklaces would exhibit their alleged benefits whether worn or remaining unpurchased in a distribution center. The Aoi et al. trial occurred over five days, but the treatment was suspended during the day. Our trial lasted only two days but the treatment was generally continuous. The Aoi et al. experiment used twenty-four participants, whereas our experiment had forty-eight. Finally, Phiten adherents might be tempted to argue that we reduced the MPT effect by covering the necklaces with tape. If so, we do not understand why masking tape and a little duct tape would reduce an effect that in the case of the Aoi et al. experiment somehow passes through rubber (or flooring material), air, and the exterior of the human body. In sum, we believe

that our classroom experiment provided a legitimate conceptual replication of the research provided by Aoi et al.

This leads to a nagging question. Why would Aoi et al. (2012) obtain significant findings when we failed to do so? The Aoi et al. results might appear legitimate on the surface, but they can also be explained in another way. Aoi et al. point to improvements that were significant in the Titanium Condition but not in the Placebo Condition. This is improper because two effects can be similar even though one effect crosses the threshold of statistical significance whereas the other effect falls short of doing so. When the Aoi et al. results are examined with this in mind, one can see that there is no compelling evidence that participants in the Titanium Condition exhibited emotional well-being improvements above and beyond those in the Placebo Condition from the beginning to the end of the experiment.

One final issue involves the amount of titanium that exists naturally. We are reluctant to develop this point because we do not believe that externally located titanium in any form exerts an influence on well-being. We nevertheless looked for titanium in four "field" samples obtained from Security Service Field in Colorado Springs, home of the Colorado Springs Sky Sox Triple A baseball team. We pulled samples from (a) the warning track, (b) the soil (with a little grass) in centerfield, (c) the infield mix approximately where the second baseman would stand, and (d) the pitcher's mound (see Figure 2). The head groundskeeper explained that each of these samples would have a fundamentally different composition. We conducted a variety of steps to dissolve our four field samples. We then analyzed the resulting solutions for titanium using an inductively coupled plasma optical emission spectrometer. We used these processes to estimate the mass weight percent of the titanium for each sample (i.e., elemental titanium mass/total mass). The estimated titanium mass weight percents were as follows: Centerfield = .000652%; Warning Track = .000242%; Pitcher's Mound = .0000907%; Second Base = .0000694%. (A detailed technical report is available upon request.) We asked Phiten for the mass weight percent of titanium in their necklaces, but they politely responded that it was a corporate secret.

The results demonstrate a remarkable irony. *It seems that many baseball players are purchasing Phiten necklaces to receive the purported benefits of MPT when they are routinely performing, presumably unbeknownst to them, on playing fields that contain titanium*. Titanium might be perceived as rare because it is costly and associated with highly technological products. Titanium is actually the ninth most-abundant element on the planet (Donachie Jr. 2000), making the Earth, conceptually speaking, a titanic ball of titanium. Titanium is so common in soil that researchers can examine titanium in animal feces to estimate soil ingestion. This procedure was used, for example, by researchers examining mule deer soil ingestion near Denver, Colorado (Arthur III and Alldredge 1979). This suggests that if titanium were to exert positive influences on emotional well-being as Phiten claims, it might be possible to gain those benefits by sleeping next to a sufficiently large bag of Colorado deer poop.

Phiten fans could argue that the titanium in soil or deer feces is different than the MPT provided in a Phiten necklace. We do not know what percentage of titanium in our field samples existed as elemental titanium (Ti), if any, or in a different form such as titanium dioxide (TiO_2). Also, titanium, in any form, might not resemble the nanoscopic-sized particles Phiten claims go into their necklaces. Such arguments raise more puzzling questions: Why would titanium dioxide work differently than titanium? Why do the titanium particles need to be nanoscopic? From our viewpoint, these questions, such as potential questions about proximity and the covering of necklaces with masking tape, are puzzling because the relationship between externally located MPT and well-being is theoretically vacuous and the evidence supporting this extraordinary claim remains unconvincing. The most straightforward answer, based on the existing evidence, is that titanium in any form, when located externally to the human body, does not exert any direct influence on personal well-being outside of more sensible explanations (e.g., a placebo effect).

Figure 2. Coauthor Craig Foster and Security Service Field's head groundskeeper taking soil samples from the field to test the amount of titanium occurring naturally in the soil.

This suggests that if titanium were to exert positive influences on emotional well-being as Phiten claims, it might be possible to gain those benefits by sleeping next to a sufficiently large bag of Colorado deer poop.

Conclusion

Science and technology thrive on new ideas, and seemingly radical theories occasionally end up appearing to be true. We therefore do not take issue

with peculiar claims. Our concern is that such claims should be supported by strong scientific evidence before consumers purchase corresponding products and journal editors publish corresponding research. A willingness to accept poorly substantiated claims can cause consumers to waste resources and scientists to waste valuable time. In this case, the externally located MPT theory is inconsistent with the known laws of physical science, the common natural presence of titanium, and now, the results associated with a classroom experiment that removed the potential placebo effect associated with Phiten necklaces.

The externally located MPT theory is inconsistent with the known laws of physical science, the common natural presence of titanium, and now, the results associated with a classroom experiment that removed the potential placebo effect associated with Phiten necklaces.

The claims surrounding MPT are at least, for the most part, benign. An MLB player taking a chance on a $20 necklace is not likely to cause any harm. Besides, the placebo effect might cause the necklaces to "work" due to their psychological power rather than their magical power. The obvious problem is that this type of pseudoscience can be genuinely harmful in other contexts. For many individuals, $20 is a considerable sum, and Phiten offers a variety of products that are far more expensive. Individuals frequently invest in similarly dubious products or services, such as faith healing or clairvoyance, which can cause physical, emotional, or financial challenges. Thus, our classroom experiment should reinforce lessons that are broader than MPT. We hope that our cadets and others learn to be effective in detecting scientifically questionable claims, and they evaluate such claims with a healthy consideration for the existing evidence. ■

Acknowledgments

We thank the Warfighter Effectiveness Research Center (WERC), which is affiliated with the Department of Behavioral Sciences and Leadership at the United States Air Force Academy, for their support.

Note

1. The survey also included an open-ended item that provided cadets the option of writing a testimonial about how the necklaces made them feel. This item followed the three dependent variables. This item did not reveal any themes that were inconsistent with the quantitative results. Thus, we only used this item to help identify participants who reported having an illness during the experimental trial.

References

Aoi, W., T. Kamata, Y. Ishiura, et al. 2012. Titanium-treated surroundings attenuate psychological stress associated with autonomic nerve regulation in office workers with daily emotional stress. *Physiology & Behavior* 108: 13–18.

Arthur III, W.J., and A.W. Alldredge. 1979. Soil ingestion by mule deer in Northcentral Colorado. *Journal of Range Management* 32(1): 67–71.

Donachie Jr., M.J. 2000. *Titanium: A Technical Guide* (2nd Edition). Materials Park, OH: ASM International.

Hansson, S.O. 2013. Defining pseudoscience and science. In M. Pigliucci and M. Boudry (Eds.), *Philosophy of Pseudoscience: Reconsidering the Demarcation Problem*. University of Chicago Press (pp. 61–77).

Hines, T. 2003. *Pseudoscience and the Paranormal* (2nd Edition). Amherst, NY: Prometheus Books.

Shermer, M. 2002. *Why People Believe Weird Things: Pseudoscience, Superstition, and Other Confusions of Our Time* (Revised and Expanded). New York, NY: St. Martin's Griffin.

Rowlands, D., S. Shultz, T. Ogawa, et al. 2014. The effects of uniquely-processed titanium on biological systems: Implications for human health and performance. *Journal of Functional Biomaterials* 5(1): 1–14.

Thagard, P. 1993. *Computational Philosophy of Science*. Cambridge, MA: MIT Press.

Craig A. Foster is a professor in the Department of Behavioral Sciences and Leadership at the United States Air Force Academy. He received his doctoral degree in social psychology from the University of North Carolina at Chapel Hill. He currently serves as his department's Director of Assessment and is the course director for their year-long statistics and research methods sequence. He also conducts research in the areas of scientific reasoning and pseudoscience. Email: craig.foster@usafa.edu.

Lt. Col. Christopher K. McClernon (PhD) is a behavioral scientist in the USAF with eighteen years of Human Factors Engineering experience. He is currently serving as an Academy Associate Professor and director of the Warfighter Effectiveness Research Center (WERC).

Lt. Col. Richard F. Reich (PhD) is an analytical chemist in the USAF with twenty years of research experience. He is currently an associate professor and the director of Faculty Research for the Chemistry Department at the U.S. Air Force Academy.

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the United States Air Force Academy, the Air Force, the Department of Defense, or the U.S. government.

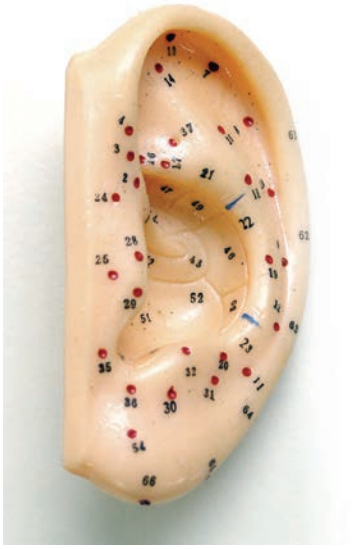
Stick It In Your Ear! How Not To Do Science

Ear acupuncture claims to relieve sore throats. A new study seeming to support that idea is so poorly done that it provides a textbook example of how to distinguish between good and bad science.

HARRIET HALL

Have a sore throat? No worries! No need for lozenges, medicines, or home remedies. All you need to do is let someone stick needles in your ear! According to a recent study, ear acupuncture relieves sore throats. Do you believe that? I don't. That's one of those extraordinary claims that would require extraordinary evidence, but the researchers didn't even provide ordinary evidence. The study is a great example of how *not* to do science.

Acupuncture theory is based on a prescientific vitalistic concept: an unmeasurable, undetectable energy called "qi" supposedly flows through meridians and can be accessed at acupoints, where needle stimulation is supposed to somehow unblock the flow of qi, which is somehow supposed to relieve pain and improve health. Qi, meridians, and acupoints are imaginary, but that doesn't necessarily mean acupuncture *can't* possibly work. It's not implausible that sticking needles into the skin might have some physiologic effects, so it is reasonable to do scientific studies—and thousands of studies have been done, some better than others. The results have been disappointing. It is not reasonable to conclude from the existing published studies that acupuncture works.



Some people believe acupuncture is an effective way to relieve pain, but the evidence from scientific studies and systematic reviews is mixed. Any positive effects can be attributed to suggestion and the surrounding rituals, and the effects are too small in magnitude to have any clinical importance. The most rigorous studies have shown that sham acupuncture works just as well as "real" acupuncture. It doesn't matter where you put the needles, and in fact it doesn't matter whether you use needles at all. In one study, simply touching the skin surface with a toothpick worked just as well as penetrating the skin with a needle (Cherkin et al. 2009). There was even a study where subjects were given a "phantom limb" illusion that a rubber hand was their own hand, and they got similar results from acupuncturing the rubber hand! (Chae et al. 2015). The main thing that seems to matter is whether the patients believe acupuncture will work. If they get a sham procedure but think they got the real thing, they will think it worked. If they get the real thing but think they got a sham procedure, they will think it didn't work. It has been pretty well established that acupuncture is nothing more than a theatrical placebo (Colquhoun and Novella 2013).

The Center for Inquiry issued a position paper on acupuncture that concludes:

> It is becoming increasingly clear that the placebo effect accounts for much of the optimistic research on acupuncture published between the 1970s and 1990s. With the development of sham needles during the past decade—needles which retract like stage knives—researchers have since been able to more accurately assess the therapeutic effects of acupuncture. The result has been a complete unraveling of nearly all acupuncture claims. . . . The bulk of recent research strongly tends towards the hypothesis that acupuncture's positive effects are mainly

> due to a built-in expectation. . . . (Slack 2010)

When *The Medical Letter* reviewed acupuncture in 2006, it concluded "Acupuncture alone has not been shown in rigorous, duplicated studies to benefit any defined medical condition." Our own CSI fellow, Steven Novella, coauthored the paper that concluded acupuncture was nothing more than a theatrical placebo (Colquhoun and Novella 2013). Medical ethicists unanimously agree that doctors should not prescribe placebos. So why are some doctors still recommending acupuncture?

The Air Force doctors clearly have drunk the Kool-Aid, because they allege that points on the ear correspond to areas on the body and stimulating them "balances the flow of the body's energy or qi."

Unfortunately, there are many doctors who lack critical thinking skills and don't really understand science or the psychology of cognitive errors. They don't all read Skeptical Inquirer or the *Science-Based Medicine* blog. They should.

The history of acupuncture research is revealing. There were never any controlled studies to verify the alleged location of meridians and acupoints or their alleged connections to other parts of the anatomy. They transposed human diagrams onto animals without any testing for validity; the acupuncture diagram for horses, for example, shows gallbladder meridians. Horses don't have gallbladders.

There are many different systems of acupuncture, some involving needles and some involving various kinds of stimulation of acupoints through intact skin (with electricity, light, heat, and other modalities). The number of meridians and acupoints varies among the different systems. In traditional acupuncture, there were originally 365 acupoints to symbolically correspond to the days of the year; now there are over 2,000. In Korean acupuncture, there are 300 acupoints, all on the hand. In other systems, they are found only on the ear, scalp, tongue, or foot. With all those different acupoints in all those different systems, is there any spot on the body that *isn't* an acupoint in some system? Yes, there is: no system uses points on the male genitalia. Draw your own conclusions! A variant called "tong ren" doesn't use acupoints at all; the patient rhythmically taps an acupuncture doll with a metal hammer. The online video of tong ren (https://www.youtube.com/watch?v=_I4r3FrzFBc) has to be seen to be believed: Is there no limit to human gullibility? As far as I know, no one has ever thought to try testing one system of acupuncture against another to find out which one is superior. For that matter, no one has ever thought to test homeopathy, chiropractic, acupuncture, and Reiki against each other. Alternative medicine simply doesn't think that way. Anything goes.

The sore throat study didn't use traditional acupuncture. It used ear acupuncture—and not even standard ear acupuncture but a simplified version. Why? Because the researchers were Air Force doctors, and the Air Force has been teaching ear acupuncture as "battlefield acupuncture" to its doctors under the guidance of Col. Richard Niemtzow. They clearly have drunk the Kool-Aid, because they allege that points on the ear correspond to areas on the body and stimulating them "balances the flow of the body's energy or qi." Their modified procedure involves five short needles that are left in place to eventually fall out on their own; the method is taught to non-acupuncturists in a four-hour workshop. The authors claim that there is research supporting ear acupuncture, but they admit that there is only "limited data" regarding the modified technique. You'd think that before they forged ahead to use it on wounded soldiers on the battlefield, they'd want convincing evidence that it worked. There isn't any.

Ear acupuncture isn't as silly as tong ren, but it's still pretty silly. It was invented by a Frenchman, Dr. Paul Nogier, in 1957. He invented it all by himself—not through science but through intuition and epiphany. He looked at the external ear, the pinna, and imagined that it looked sort of like a fetus curled up in its mother's womb. I can tell you he had a much better imagination than I do; I can't see the resemblance. He arbitrarily assigned a spot on the ear to correspond to the part of the imagined fetus, tried inserting needles in ears, and confirmation bias kicked in to convince him that it worked on the corresponding part of the body. He originally used thirty points; now ear acupuncturists claim to have identified 120. The ear is pretty small to accommodate 120 acupoints, and anyway there are no connections between the ear and those other parts of the body.

The study, "Ear Acupuncture for Acute Sore Throat: A Randomized Controlled Trial," (Moss and Crawford 2015) was published in the *Journal of the American Board of Family Medicine*. The fact that the editors did not reject the study is both surprising and disappointing.

Moss and Crawford studied fifty-four patients who presented to an Air Force family medicine clinic with pain from sore throat. They were randomized into two groups: one got standard treatment (ibuprofen, plus antibiotics when indicated); the other got standard treatment plus ear acupuncture. There was no blinding and no sham acupuncture control group. They didn't even standardize the treatment: they placed "up to 10" needles. Unblinded research associates assessed the results by phone interview. Patients in the acupuncture

group reported significantly less pain at fifteen minutes and twenty-four hours after the procedure, although at forty-eight hours there was no difference from the control group. Acupuncture patients reported taking fewer ibuprofen pills. There was no difference between the groups in time missed from work.

What's wrong with this study? Practically everything. It is a typical example of the "pragmatic trial" favored by alternative medicine. Instead of asking whether acupuncture works better than placebo to relieve pain, they gave everyone standard treatment and added acupuncture to one group. When you add *anything* to the usual treatment, you are practically guaranteed to get positive results. Patients respond to the extra attention and to suggestion. They *expect* to feel better, so they do. In this case, the needles were left in the ear as a continuing reminder that they had received special treatment. Pain is subjective, and suggestion is powerful; that's why we kiss our children's minor injuries. *Of course* the acupuncture subjects reported less pain; that's exactly what we could have predicted.

Pragmatic studies test the real-world practical performance of treatments. They have their place. A treatment that has been proven to work in a research setting with a select group of subjects and carefully controlled methods might not work as well in a real-world setting with patients who might have other illnesses or be on other medications, or where the providers might not be as rigorous in following treatment guidelines. Pragmatic studies can't establish whether a treatment works better than placebo, and they were never intended to be done on treatments that had not already been proven to work.

That's why studies must have a convincing control group. These researchers could have used a sham acupuncture control where they used retractable needles or put the needles in the "wrong" spots, in the ear or in other parts of the body. But they rejected the whole idea of a sham acupuncture control. Their amazing rationale: sham acupuncture can stimulate "C" fibers and produce analgesia too, so sham acupuncture wouldn't be a placebo, it would actually be a treatment! If that were true, it would mean that acupuncture's whole treatment rigmarole is unnecessary. There would be no reason to specify acupoints: you might as well just stick needles anywhere, and no training would be needed to administer the treatment. The authors didn't even think of comparing a usual treatment group to an acupuncture group; both groups got the usual treatment. And why on Earth didn't they blind the research assistants who did the telephone interviews? That would have been so simple to do, and it would have eliminated any suspicion that they might have subtly influenced the results in some way.

When you add *anything* to the usual treatment, you are practically guaranteed to get positive results.

They got positive results, but they would have gotten positive results if they had added *any* other intervention to the usual treatment for sore throat. What if they'd offered massages, or training in meditation or relaxation exercises, or a warm scarf to wrap around the neck, or therapeutic touch to "balance their human energy fields," or funny movies to take their mind off the pain? Or even a gift certificate for a shopping spree at the local mall to boost their spirits? We can predict that those would have "worked" too, maybe equally well or better. That's why pragmatic studies such as this are useless.

It's an ill wind that blows nobody any good. This study is astonishingly poor science. It should not have been done, and it should not have been published; it didn't give us any useful information about acupuncture. But it can serve as a bad example to help us learn to distinguish between good and bad science. ■

References

Chae, Y., I.S. Lee, W.M. Jung, et al. 2015. Psychophysical and neurophysiological responses to acupuncture stimulation to incorporated rubber hand. *Neuroscience Letters* 691 (March 30): 48–52.

Cherkin, Daniel C., Karen J. Sherman, Andrew L. Avins, et al. 2009. A randomized trial comparing acupuncture, simulated acupuncture, and usual care for chronic low back pain. *JAMA Internal Medicine* 169(9): 858–66. Available online at http://archinte.jamanetwork.com/article.aspx?articleid=414934.

Colquhoun, David, and Steven P. Novella. 2013. Acupuncture is theatrical placebo. *Anesthesia & Analgesia* 116(6): 1360–63. Available online at http://journals.lww.com/anesthesia-analgesia/pages/articleviewer.aspx?year=2013&issue=06000&article=00025&type=Fulltext.

Moss, David A., and Paul Crawford. 2015. Ear acupuncture for acute sore throat: A randomized controlled trial. *Journal of the American Board of Family Medicine* 28: 697–705. Available online at http://www.jabfm.org/content/28/6/697.full.

Slack, Robert. 2010. Acupuncture: A science-based assessment. Center for Inquiry, Inc. (June). Available online at http://www.centerforinquiry.net/uploads/attachments/Acupuncture_Final_Paper.pdf.

Harriet Hall, MD, is a retired Air Force physician and flight surgeon who writes and educates about questionable medical claims. She is an editor of the blog *Science-Based Medicine*, author of *Women Aren't Supposed to Fly: Memoirs of a Female Flight Surgeon*, and coauthor of the 2012 textbook *Consumer Health: Guide to Intelligent Decisions*. She is an SI contributing editor and a fellow and member of the Executive Council of the Committee for Skeptical Inquiry.

A Testament of Belief Masquerading as Science

Need there be a conflict between science and religion? Francis S. Collins thinks not, but his "evidence for belief" disintegrates under scrutiny, revealing instead a personal testament of belief.

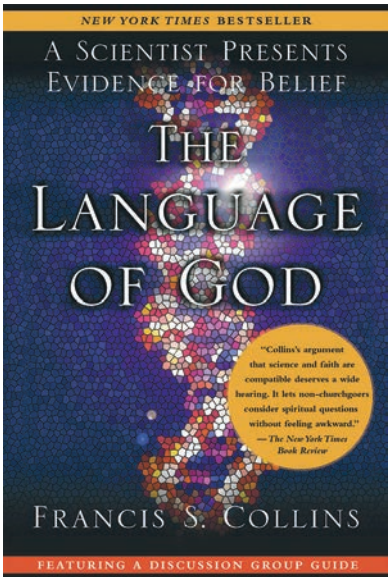
MICHAEL J. REYNOLDS

In a recent study funded by the John Templeton Foundation and published in the journal *Public Understanding of Science*, researchers found:

> Zoologist Richard Dawkins's [author of *The God Delusion*] influence as a public intellectual . . . does not persuade new readers that science and religion are in conflict, [while] . . . biologist Francis Collins [author of *The Language of God: A Scientist Presents Evidence for Belief*] . . . could persuade audiences that science and faith can be compatible. (Fahy 2015, 5)

How does Collins's assertion of compatibility stand up to scrutiny?

Francis S. Collins's *The Language of God* offers a wealth of excellent science, but does the book do what it says on the cover and present "evidence for belief?" Or is Archbishop Desmond Tutu closer to the mark when he writes in his review, "Francis Collins, eminent scientist, tells us why he is also a believer"? In short, not "evidence" but a personal testimony of faith. Collins is careful to couch his concept of God in conjectural terms, but one is left in no doubt about what sort of deity lies at the heart of his belief. For Collins, it seems, the universe serves one primary purpose: to satisfy God's desire for personal fellowship with humankind. "If God is the creator of the universe, if God had a specific plan for the arrival of humankind on the scene, and if He had a desire for personal fellowship with humans . . ." (Collins 2007, 230).


NEW YORK TIMES BESTSELLER
A SCIENTIST PRESENTS EVIDENCE FOR BELIEF
THE LANGUAGE OF GOD
"Collins's argument that science and faith are compatible deserves a wide hearing. It lets non-churchgoers consider spiritual questions without feeling awkward." —The New York Times Book Review
FRANCIS S. COLLINS
FEATURING A DISCUSSION GROUP GUIDE

Collins, a prominent biologist (a Nobel laureate and director of the National Institutes of Health) and an evangelical Christian, accepts the current consensus concerning the age of the universe—approximately fourteen billion years. So, if God created the universe in order that he might have fellowship with human beings, why didn't he cut to the chase? Current anthropological evidence indicates that humankind, in its modern anatomical form, arrived on the scene no more than 200,000 years ago. Thus, for 99.998 percent of the life of the universe, Collins's God has had to do without his desired fellowship with human beings.

"The Moral Law still stands out for me as the strongest signpost to God" (Collins 2007, 218), writes Collins after twenty-eight years as a believer. For Collins, this concept, deriving from the writings of Christian apologist C.S. Lewis, is key "evidence for belief." Although Lewis was a man of significant accomplishments, the many arenas in which he made his reputation did not extend to science. Nor was Lewis without his critics. Philosopher John Beverslui writes in the introduction to his critique of Lewis's work:

> The apparent cogency of [Lewis's] arguments depends on his rhetoric rather than on his logic… Once his arguments are stripped of their powerful rhetorical content, their apparent cogency largely vanishes and their apparent persuasiveness largely evaporates. The reason is clear: it is not the logic, but the rhetoric that is doing most of the work. (Beversluis 2008, 20)

Collins writes that ". . . the concept of right and wrong appears to be universal among all members of the human species . . ." and, "it thus seems to be a phenomenon approaching that of a law, like the law of gravitation or of special relativity" (Collins 2007, 22). To support this startling assertion, Collins offers an extensive quote from

Lewis—but little more—asserting that a thorough reading of *The Encyclopedia of Religion and Ethics* will find demonstrated a common acceptance, across a wide array of cultures and communities, of what constitutes moral "rights and wrongs" (24). Thereafter, Collins treats the existence of the Moral Law pretty much as a given. The problem for the Moral Law is that differences in moralizations, across cultures and communities and over the course of human history, have been and are real.

If Collins is right, however, it would seem reasonable to expect the exercise of the Moral Law to engage some specific aspect or aspects of human physiology. The cerebrum—the cerebral cortex with its various subdivisions—is the most likely arena in which the Moral Law would play out. As Steven Pinker puts it, "The neuroanatomy suggests that in *Homo sapiens* primitive impulses of rage, fear, and craving must contend with the cerebral restraints of prudence, moralization, and self-control" (Pinker 2011, 502). Whether these "restraints" constitute the workings of Collins's Moral Law is open to question. Pinker goes on to describe the work of psychologist Adriane Raine:

> In one experiment, Raine compared the brains of prisoners who had committed an impulsive murder with those who had killed with premeditation. Only the impulsive murderers showed a malfunction in their orbital cortex, suggesting that the self-control implemented by this part of the brain is a major inhibitor of violence. (Pinker 2011, 505)

In Raine's studies of the brains of prisoners convicted of premeditated murder, the lack of shrinkage in the orbital cortex would seem to indicate that these individuals may have turned a deaf ear to the Moral Law's promptings, whereas, for the impulsive murderers, a malfunction in the orbital cortex would seem to indicate that they were denied full access to the Moral Law from the outset. Why would a "loving, logical and consistent" (Collins 2007, 177) god allow some individuals with whom he desires fellowship to suffer a deficiency the effects of which are likely to reduce or nullify access to the operations of the Moral Law by which the deity wishes them to be guided?

In his chapter "The Origins of the Universe," Collins sets out his arguments for God as the creator of the universe, writing "The Big Bang cries out for a divine explanation. It forces the conclusion that nature had a defined beginning. I cannot see how nature could have created itself. Only a supernatural force that is outside space and time could have done that" (67). In support of this view, Collins zeroes in on the "fine-tuned universe"—the proposition that "the existence of the universe as we know it rests upon a knife-edge of improbability" (73). The "improbability" derives from the fact that, according to cosmologists, there are six (Collins asserts fifteen) dimensionless physical constants that, if varied by infinitesimal amounts, would preclude the formation of our sort of universe.

The problem with Collins's use of this and other quotes is that the reader is left with the mistaken impression that Penzias and other scientists offer support for Collins's God-hypothesis.

So how did the universe come to be "fine-tuned" as it is? Collins considers three scenarios: 1) the existence of an infinite number of diverse, parallel universes giving rise to the likelihood of one like ours (the multiverse hypothesis); 2) pure, blind luck; and 3) the agency of a supernatural entity. Collins then goes on to assess the probability of each scenario.

Collins dismisses Scenario 2 as the least plausible of the three, although, apart from stating that it is "wildly improbable" (Collins 2007, 74), he advances no reasons for so doing. Scenario 1 he views as straining credulity (76). Not unexpectedly, he opts for Scenario 3: "The Big Bang itself seems to point strongly toward a Creator, otherwise the question of what came before is left hanging in the air" (77). This assertion prompts the question, "What came before the Creator?"

As implausible as Collins may find Scenario 2, according to renowned theoretical physicist Lawrence Krauss:

> Given everything we know and every measure we made about the universe, it's plausible that the universe came from nothing: no time, no space, no particles and no radiation. A universe that did come from nothing, by known laws of physics and some reasonable extrapolations from them, would have the characteristics of our universe. (Nogueira 2015, 13)

In concluding that "the God hypothesis solves some of the deeply troubling questions about what came before the Big Bang, and why the universe seems to be so exquisitely tuned for us to be here" (Collins 2007, 81), Collins goes a long way out on a limb with little or no evidential support. Collins goes on to marshal an array of scientific notables, quoting them in support of his God-hypothesis. For example, he quotes Arno Penzias: "The best data we have are exactly what I would have predicted had I nothing to go on but the five books of Moses, the Psalms, and the Bible as a whole" (Collins 2007, 76). Collins's context implies Penzias's support for Scenario 3, i.e., that the universe is the work of a supernatural creator.

Recourse to the full *New York Times* article tells a different story, however. In the interview, Penzias is discussing whether the universe is "open" or "closed." Given that Genesis describes a beginning for the universe but is silent on its ultimate fate, Penzias's remark clearly relates to the "closed vs. open" debate, and not at all to the matter of how the universe came into being in the first instance. The problem with Collins's use of this and other quotes is that the reader is left with the mistaken impression that Penzias and other scientists offer support for Collins's God-hypothesis—support that, when the quotes are examined in context, appears weak or nonexistent.

When arguing for the possibility of

miracles and defending his preference for the Creator Scenario, Collins puts forward illustrative parables: one his own—the 52-Ace-of-Spades deck of cards (49); and one from philosopher John Leslie—the firing squad that misses its target (77). The difficulty with such parables lies in the fact that the parable spinner can set the initial conditions so as to weight the parable in favor of a preferred conclusion. In both these instances, the initial conditions are set in such terms that the likelihood of the outcome in each situation being due to chance appears highly improbable, thus directing the reader toward the conclusion that the outcomes are a result of agency.

What of the suffering inflicted on mankind in the name of religion and morality? Collins's view can only be described as "coy"—laying responsibility on the frailty of human beings.

Consider another parable (not of Collins's devising): A man is arrested for hiring a hit man to kill his neighbor's devoted wife. At his trial, he enters a plea of "not guilty" due to extenuating circumstances. He tells the court that, over many years, he has watched his neighbor take the murdered woman more and more for granted. Day after day, he has seen her evident devotion to her husband go unacknowledged. He has spoken to the neighbor, but his interventions have been met with indifference. What better way, then, to bring the neighbor to a realization of how the poor woman's devotion has enhanced his life than to deprive him of her. Although the accused man admits to being aware of the shock, anguish, and pain that the neighbor might experience as a result of his wife's murder, he tells the court that the contract-killing, undertaken as it was in the interest of teaching the neighbor a much-needed lesson, should be considered justifiable.

Rare indeed would be the jury that would acquit on the grounds of such a defense, yet this scenario, in its essence, is what Collins advances to exculpate his deity in the light of a horrific circumstance visited upon a member of his family. Commenting upon Collins's response to such a tragic personal event runs a serious risk of causing offense. Yet Collins himself uses this deeply regrettable incident to illustrate his answer to the question "Why would a loving God allow suffering in the world?" (Collins 2007, 42)

Collins distinguishes "moral evil"—that inflicted by mankind upon mankind—from "physical evil" (44)—that which arises from natural phenomena beyond mankind's control. Collins attributes the "moral evil" to human beings, in the exercise of their free will, choosing to ignore the promptings of the Moral Law. Collins writes concerning "physical evil": "If at the beginning of time God chose to use these forces [i.e., natural phenomena] to create human beings then the inevitability of these other painful consequences was also assured" (45).

As with the parable of the man who sought, through murder, to teach his neighbor a lesson, one is prompted to ask, could not an all-powerful god have found less drastic ways to lead his children to grace? Collins acknowledges the difficulty this conundrum poses but writes: ". . . if God is loving and wishes the best for us, then perhaps His plan is not our plan" (Collins 2007, 45)—a "fudge" behind which the evangelical community retreats when circumstances, moral or physical, visit suffering upon the innocent.

What of the suffering inflicted on mankind in the name of religion and morality? Collins's view can only be described as "coy"—laying responsibility on the frailty of human beings—those "rusty containers" into which is poured the "pure, clean water of spiritual truth" (40, 164). Historically, much of the religiously inspired suffering visited upon mankind has arisen from conflicting interpretations of what constitutes the "pure, clean water of spiritual truth." And what of Genesis 1: 26–27 "And God said, Let us make man in our image, after our likeness . . ." and "So God created man in his own image, in the image of God created he him . . ."? No mention there of "rusty containers."

In his chapter "Option 4: BioLogos," Collins sets out, in six stages, his preferred version of events from the big bang to the advent of *Homo sapiens* (200). Although it is generally known as Theistic Evolution (TE), Collins, finding the label unsatisfactory, rechristens the concept "BioLogos." He writes, "It [BioLogos] is intellectually rigorous; it provides answers to many otherwise puzzling questions and it allows science and faith to fortify each other like two unshakeable pillars holding up a building called Truth" (210).

Stages 1 through 5 of Theistic Evolution/BioLogos more or less follow the path of the mainstream scientific consensus. Stage 6, however, makes a significant departure. Collins writes:

> 6. But humans are also unique in ways that defy evolutionary explanation and point to our spiritual nature. This includes the existence of the Moral Law (the knowledge of right and wrong) and the search for God that characterizes all human culture throughout history. (200)

Collins rests this claim on two previous arguments, only weakly established if at all.

Collins's robust endorsement of Darwinian evolution poses a conundrum for BioLogos, which Collins rather strains to address. The conundrum arises from the inherently "random, potentially heartless and inefficient" (Collins 2007, 204) nature of the evolutionary process. In the face of such randomness, what certainty could God have had that *Homo sapiens*'s evolutionary pathway would not have been expunged by some random extinction event?

Collins holds that the solution to this conundrum is "readily at hand," writing: "If God is outside of nature, then He is outside of space and time. In that context, God could in the moment of creation of the universe also know every detail of the future." And, "In that context, evolution could appear to us to be driven by chance, but from God's perspective the outcome would be entirely specified" (205). But this "solution" opens up yet another co-

nundrum. If Collins's deity is capable of knowing "every detail of the future" and the outcome of his creation is "entirely specified," where then fits free will?

It becomes hard to resist the conclusion that Collins's "ready at hand" solution to the unpredictability of Darwinian evolution suggests that free will is little more than an illusion—a sleight-of-hand practiced upon unwitting humankind by a Cosmological Trickster who, as Collins claims in an earlier chapter, knows "in advance the thoughts and actions" (87) of the creatures with whom he supposedly seeks fellowship.

To account for the "unique" human attributes that BioLogos asserts "defy evolutionary explanation," Collins turns to the biblical story of Adam and Eve. The scientist in him inclines Collins toward the view that Genesis 2, rather than being a literal rendering of prehistoric events, is "a symbolic allegory of the entrance of the human soul into a previously soulless animal kingdom" (207). Collins apparently considers what he calls "the entrance of the spiritual nature (the soul) and the Moral Law into humanity" to have been a literal event that took place at some specific point along *Homo sapiens*'s evolutionary journey. In support of this assertion, Collins turns again to C.S. Lewis.

Lewis spins his own fanciful rendering of Genesis 2 with a casual nod in the direction of Darwinian evolution but climaxing thus: "Then, in the fullness of time, God caused to descend upon this organism both on its psychology and physiology, a new kind of consciousness which could say 'I' and 'me' which could look upon itself as an object" (Collins 2007, 208). This reads suspiciously like the advent of self-recognition: a characteristic that may emerge in an organism once a given threshold of neurological complexity is crossed. Research using the Mirror Self-Recognition Test (MSR) suggests that, as well as humans, some elephants, dolphins, orcas, the Eurasian magpie, and, of course, other great apes (the gorilla excepted) appear to have crossed this threshold. While this finding is not without controversy, and self-awareness may be weakly expressed in other species, it would appear that such a faculty might not be as unique to humans as Collins would have us believe. While this possibility has emerged since Lewis wrote, Lewis remains true to form in failing to advance any supporting evidence for his whimsical suppositions.

Collins acknowledges that "BioLogos is not intended as a scientific theory. Its truth can be tested only by the spiritual logic of the heart, the mind, and the soul" (204). One is led to wonder, therefore, what the concept—and Collins's attendant arguments for it—is doing in a book subtitled "A Scientist Presents Evidence for Belief."

Collins writes: "The theistic evolution perspective cannot, of course, prove that God is real, as no logical argument can fully achieve that. Belief in God will always require a leap of faith" (45). As a believer, Collins displays great grace in making this admission.

In science, most paradigm-breaking propositions require a leap of faith when initially advanced. The key word in Collins's admission about "belief in God," however, is "always." To science a belief that "always requires a leap of faith" is anathema. Science is about building structures of empirical evidence that inexorably reduce the leap required to reach belief.

Francis S. Collins enjoys a well-earned and much-deserved reputation as a distinguished scientist and researcher. Further, he emerges from the pages of *The Language of God* as a thoroughly decent, sincere, and compassionate individual. Regrettably, however, his effort is unlikely to contribute greatly to his desire to bring about peace between the "warring" camps of faith and science. Despite his explicit intention to present "evidence for belief," both Collins's God-hypothesis and his BioLogos (Stage 6) are, by his own admission, untestable hypotheses and cannot, therefore, be considered scientific.

While applicable perhaps to faith, Collins's metaphor ". . . two unshakeable pillars holding up a building called Truth" cannot not be applicable to science, as science does not seek "Truth." Rather, science seeks, through occasionally giant but typically small, incremental steps to expand humankind's understanding of nature and its works; and, through empirical evidence, augment confidence (but never certainty) in that understanding. It would not be unreasonable to view archaic attempts to understand and to define nature—attempts most of which long predate scientific methodology (as imperfectly begun by Aristotle and his fellow Greeks)—as "hypotheses" founded on observation and deduction valid for the time of their devising. Difficulties arise, however, when such "hypotheses" don the mantle of sanctity, rendering them impervious to any challenge from fresh observation and deduction. Where faith consistently rides to the defense of its "hypotheses," science ever seeks opportunities to tear down its own edifices as new evidence emerges.

One is left wishing that Collins had, from the outset, acknowledged that *The Language of God* is, in the end, a personal testament of faith to which he is fully entitled but which, with his claim that it presents "evidence for belief," risks diminishing his standing in the eyes of much of the scientific community. ■

References

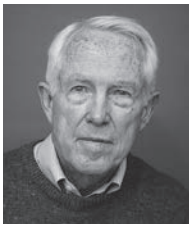
Beversluis, John. 2008. *C.S. Lewis and the Search for Rational Religion.* Amherst, NY: Prometheus Books.

Collins, Francis S. 2007. *The Language of God: A Scientist Presents Evidence for Belief.* New York: Free Press (Simon & Schuster).

Fahy, Declan. 2015. Dawkins, Collins, and the science-religion debate: A new sociological study. Skeptical Inquirer 39(5): 5–6.

Nogueira, Felipe. 2015. To better understand science and the universe. *Skeptical Briefs* 25(3).

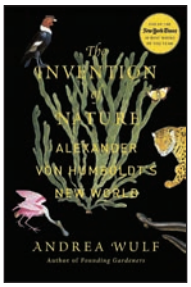
Pinker, Steven. 2011. *Better Angels of Our Nature: The Decline of Violence in History and Its Causes.* London: Penguin Books.



Michael J. Reynolds, a Canadian living in Somerset in the United Kingdom, is an actor by profession and an avid reader of scientific and skeptical literature. His early life experiences gave him an intimate acquaintance with the evangelical mind-set.

The Nature of 'Nature'

PAUL BROWN



The Invention of Nature: Alexander von Humboldt's New World. By Andrea Wulf. Alfred A. Knopf, New York, 2015. ISBN 978-0-385-35066-2. 472 pp. Hardcover, $30.

So just what is the nature of *nature*? Andrea Wulf's book is a sprightly scientific and personal biography of Alexander von Humboldt, a sadly forgotten giant of the Enlightenment. He was a man who traveled widely, measured rigorously, partied hard, thought deeply, influenced almost everyone, and stumbled onto a highly original and enduring way of thinking about that introductory question.

Von Humboldt's story should appeal to skeptics and humanists firstly because it is intrinsically interesting. Wulf's book tells the absorbing tale of a major Enlightenment figure: someone who charmed artists and poets such as Goethe and Schiller; set an alpine ascent record; rubbed shoulders with political leaders Simon Bolivar, Napoleon, and Thomas Jefferson; discovered an ocean current (and not even the one named after him!); collaborated with scientists such as Joseph Banks, Henry Cavendish, and Pierre-Simon Laplace; organized a global program for measuring Earth's geomagnetic variations; lionized the literary salon's of Paris; and still had time to publish prolifically. Wulf's book is also fascinating for the story it tells about the early development of what today are loosely grouped into the "earth sciences"—geology, botany, meteorology, oceanography, ecology, and so on.

Alexander Humboldt (not a "von" by birth—he was ennobled later) lived a long, extraordinary life. Born in Berlin in 1769, he came of age in the artistic and diplomatic hurly-burly of the court of Prussia's Frederick the Great. From the bare facts of his story, it's apparent that the ambitions his mother and her society constructed for young Alexander weren't ones he shared. He was compelled to attend schools of accounting and mining. He chose to wander his family's estate collecting and cataloging leaves and insects.

Alexander's emancipation came with his mother's death. She passed, he inherited, and our suddenly wealthy young man's fancy turned to . . . a scientific expedition to South America! So he roamed over what is now Venezuela, Colombia, Brazil, Mexico, and Cuba for four years, with a side trip to Washington to meet Thomas Jefferson just as Jefferson's Corps of Discovery departed St. Louis for all points west. Along the way he foraged the world's best collection of South American plants and animals, drew detailed and accurate maps, filled log books with meteorological measurements, acquired contempt for the institution of slavery, and developed his enormously insightful ideas about how all of nature's many and varied life-forms fit together.

That's no small scientific breakthrough, though. Our original question, writ very large, is "What is the *nature* of all of nature?" Prior to the adventuresome Alexander, questions such as this in the West had been dismissed with—surprise, surprise—religious bromide or else sentimentality. The Greeks, of course, cared about *what* was what but their thinking imbued the natural world with human values to the extent that books such as Plato's *Timeas* read like an extended indulgence in the naturalistic fallacy. The Universe was "obviously" good, "obviously" all designed and put there for the benefit of just one species. So "obviously" to study the natural world was to particularize each aspect of its goodness.

Everywhere, human beings occupied the central position in nature. In China, botany was framed as an herbalist questions about how plants contributed to human health, while zoology was all about animal husbandry. The Western mind was enthralled to the Bible's in-

junction to "go forth and multiply" and God's word that all of nature was there for us to name and to exploit. As Alexander began his scrabbling in the dust, mud, and blood, the dominant rationalist model of how the world worked was Descartes's, who held that plants and animals were mere machines; each individual independent in its operation, each constructed of divisible sub-mechanisms, each species unconnected to others.

Alexander's new understanding of the natural world was so obvious, yet so profound, that it swept all that came before it aside. He inverted the human-centered view of nature and emphasized instead the interconnectedness of organisms, species, and geography. Today, von Humboldt's holistic and integrated view of nature is thoroughly conventional. His genius was to establish it as fact through careful observation. Even the fundamental tenet of the conservation movement, something we think of as very modern, was something von Humboldt established with his observations of rainfall, water levels, and soil fertility on colonial plantations. Human activity, von Humboldt determined, measurably changes the natural world.

It was Alexander von Humboldt who first articulated self-evident ideas such as "the web of life" and "climate," and pointed out that human beings are embedded within the natural world, for good or ill.

Details about how, where, and why Alexander came to his revelation are well explained in Wulf's book, as is his extensive catalogue of lesser yet still scientifically important insights. For example, von Humboldt came up with the concept of the lines of equal barometric pressure (called isobars) and temperature (called isotherms) that today decorate nightly TV weather maps. Only in von Humboldt's fertile mind they see additional service as a means of organizing the entire globe into climate zones, which he saw as intertwined with the geographic distribution of plants and animals, which in turn led him to a description of the world in terms of its biogeography.

How influential was von Humboldt? It's telling that fully a third of Wulf's book is devoted to descriptions of what others made of his writing, not all of it scientific. Von Humboldt's new vision of nature had a certain moral and aesthetic appeal, especially to generations born into the wilder landscape of the new world. The impact of von Humboldt's writings underlines how true it is that the past is another country. During the early nineteenth century, scientific advances had the potential to alter the way entire societies viewed their world. Much of what von Humboldt inspired was pretty inchoate, of course. For every John Muir, who opened his travel journals boldly "asserting his place in Humboldt's cosmos" and dedicated his life to protecting at least some of it from the impact of humanity, there's a Henry David Thoreau and the incoherent mysticism of his transcendentalism.

Of special interest to many readers will be the extensive parallels between the lives and work of von Humboldt and Charles Darwin. Both were born into upper middle-class privilege. Each opted initially into an unsuitable occupation. Both lives were shaped by expeditions in and around South America, where their assumptions about the placidity of the Earth and the beneficence of nature were upended by earthquakes. Both made enormous (indeed, seminal) contributions in a broad variety of fields. Indeed, reading Humboldt today, it's possible that he came very close to an evolutionary explanation for the diversity of life. Many of his observations about biogeography pre-dated Wallace's. Darwin repeatedly brought Humboldt's writing and scientific thought up in his diaries and cited him in his published works. Darwin's famous "tangled bank" paragraph at the end of *On the Origin of Species* is a succinct reiteration of von Humboldt's core ideas.

So why no evolutionary theory from Alexander von Humboldt? Wulf's book invites a reader's speculation. Was von Humboldt so much of a polymath, with his thought leaping from idea to idea, that his ability to bear down with intensity on any one problem was compromised? Did von Humboldt's gregarious and sociable nature embroil him in too many soirees, in contrast to Darwin's post-Beagle retreat into a rural, hearth-and-home-centered life? Or did von Humboldt's lifelong commitment to a tolerant deism and creationism blind him to deeper truths about the natural world implicit in his science?

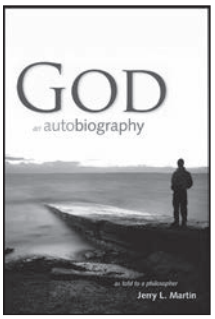
Of special interest to many readers will be the extensive parallels between the lives and work of von Humboldt and Charles Darwin.

Our hero died in May 1859, aged ninety. He never had the chance to read Darwin's book, which was published in England in November of that year. This was a pity. What Andrea Wulf's remarkable book makes clear is how much Darwin owed this Prussian giant, and the intellectual relationship between them reminds us that science, like nature, is a "tangled bank" of interleaving observation and theory. Hopefully her book will help resurrect the reputation of Alexander von Humboldt, to whose singular efforts we owe so much of the wallpaper of how we think about the natural world and our place in it. ■

Paul Brown is a computer scientist specializing in building data management programs for very large-scale science projects. He has previously reviewed for SI books by Daniel Dennett, Nate Silver, and Daniel Kahneman.

Hallucination or Revelation?

HARRIET HALL



God: An Autobiography. By Jerry L. Martin. Caladium Publishing Co., Doylestown PA, 2016. ISBN 978-0-9967253-1-6. 287 pages, $9.99 kindle.

Jerry Martin was raised as a Christian but had been an agnostic ever since college. Then one day God spoke to him.

He was in the throes of new love with the woman who is now his second wife, and he was so ecstatically happy he suddenly felt the need to give thanks in prayer. When he prayed for the third time and asked for guidance, a fountain appeared. Then a voice spoke. It sounded like his own voice. His wife was sitting next to him at the time, but she heard nothing and saw nothing. In other words, he experienced visual and auditory hallucinations.

He kept hearing the voice. At first it gave him trivial commands like "Don't eat yet" or "Sit in a different chair." This progressed to an ongoing dialogue in which the voice identified itself as God, directed him to read books about philosophy and religion, answered his questions, explained away apparent contradictions in the Bible and between different religions, and asked him to write God's autobiography. He questioned whether the voice was divine, but he thought of Pascal's wager and made the conscious choice to believe.

Eventually, he also talked to Jesus. Jesus first appeared to him as a nebulous image through the windshield of his car when he was stopped at a traffic light. At one point he asked Jesus if the crucifixion hurt. Jesus answered, "Of course." One day Jesus appeared to him and kissed him on the lips; it was erotic, as if Jesus were making love to him. He worried about whether to tell his Jewish wife about his experiences with Jesus, but the voice said not to worry: "Abigail is a special friend of mine. She understands me as few do." How very flattering! He is special because God talks to him, and he has a wife who is special too.

At one point, Martin decided to contact Jesus's mother, Mary, to ask her advice about what present to give his wife for Valentine's Day. He prayed, and she spoke to him. Her presence was accompanied by fragrances and soft pastel lights and an intense feeling of love and joy. They had a conversation, but in his excitement he forgot to ask her about the present. He doesn't say whether he ever tried praying to her again. He ended up getting his gift advice from a terrestrial friend.

The voice consistently comes to him whenever he prays, and he converses with it without speaking out loud. The voice explains that God is not exactly omnipotent, omniscient, omnibenevolent, or unchanging. It describes how God felt as he created (and was himself created by) the big bang; he had no plans at that point. God is still primitive and undeveloped today (after fourteen billion years?) and he is still trying to learn "how to be effective in bringing man forward." God is slowly evolving, and he suffers and needs people for companionship. He needs to be worshipped. Why? Because "that is the appropriate response to Me."

Reincarnation is true, Martin is told, but it's not what we think it is. Each of the different religions has part of the truth; each has insight into an aspect of God's nature. The voice has him read about Christianity, Judaism, Islam, polytheism, Hinduism, Buddhism, Zoroastrianism, ancient Egyptian beliefs, ancient Chinese beliefs, and the Tao, as well as the works of many philosophers; and they have long, involved discussions about the details of what he has read. The voice tells him that there is to be a new project to develop a holistic world theology, fitting all the separate religious traditions together in a meaningful way. And guess who has been chosen to start on that project as soon as he finishes writing God's autobiography?

The voice tells him that his doubts about the voice's identity are only natural but that he mustn't let doubts interfere with faith. He is confused by a number of apparently irreconcilable discrepancies; for instance, one time the voice tells him God loves all humans, and another time it tells him God only

loves sinners. When he asks for clarification, the voice tells him not to get hung up on details, to stop thinking, and stop asking rational questions. It reminds him that he already believes in things he can't see. He believes that other people have minds, so he argues it is just as reasonable to believe that God exists.

It struck me as strange that Martin's interactions with the voice were interrupted at least twice. He stopped praying for a year when he was ill and again for six months when some of the voice's ideas began to distress him. I also found it interesting that the voice was not politically correct; it used "man" in the older sense inclusive of men and women.

The language Martin uses often sounds vague, mystical, Deepak-Chopra-ish and New Agey, and sometimes even incoherent. Just a few examples:

- "Being facing Being, not necessarily speaking but simply facing, is what personhood is."
- Gravity is a kind of love.
- The universe is one great act of love.
- Subjectivity desires to objectify itself.

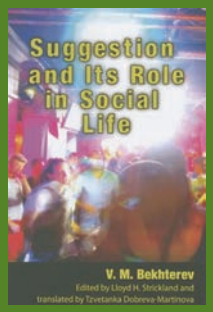
God says, through Martin, that some diseases have a spiritual cause, and virtually all diseases have a mental or spiritual component that can be healed with the right relation to God. Miracles happen all the time. They are dismissed because they are outside the scientific paradigm, even when there are reputable witnesses. They happen within the laws of nature; we just don't yet understand those laws. The voice tells him it's possible to talk to the dead, and he is impressed when his dead brother appears to him in a dream to apologize for the suffering his death caused. I'm not clear on when the dead stay around to talk to the living rather than being immediately recycled into reincarnations.

Martin's story can help us better understand the psychology of religious prophets throughout history. What it can't do is establish that God is real or that Martin actually had conversations with him. He admits to a fear that he is just somehow making all this up, but he chooses to ignore that possibility and just believe.

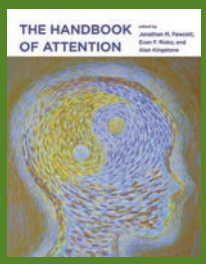
NEW AND NOTABLE]

Listing does not preclude future review.

THE FOLKLORESQUE: Reframing Folklore in a Popular Culture World. Edited by Michael Dylan Foster and Jeffrey A. Tolbert. Foster and Tolbert, both folklorists at Indiana State University, discuss the product created when popular culture appropriates or reinvents folkloric themes, characters, and images. "Folkloresque," as described in the book, is "popular culture's own (emic) perception and performance of folklore. That is, it refers to creative, often commercial products or texts that give the impression to the consumer that they derive directly from existing folkloric traditions" (p. 5). Chapters include folkloric representations in a variety of popular culture media including video games (such as the ghost-themed *Fatal Frame* series), Neil Gaiman's books, films, comic books, anime, and even popular science writing, all of which commonly draw on basic folklore genres. With many paranormal subjects imbued with folklore (urban legends, ghost stories, UFO lore, etc.), this book provides insight into how folklore is used in these commercial and mass-market contexts. Utah State University Press, 2015, 265 pp., $27.95.



SUGGESTION AND ITS ROLE IN SOCIAL LIFE. V.M. Bekhterev. Originally published in 1908, this book by pioneering Russian neurologist, psychiatrist, and psychologist Vladimir Bekhterev reviews and explains the many conflicting positions in the social and scientific thought concerning the nature and power of suggestion. He differentiates the process from persuasion and hypnosis and discusses suggestion and autosuggestion in the waking state, examining their effectiveness on feeling, thought, and behavior. Perhaps the book's most relevant chapters to skeptics are "Suggestion in the Hypnotic State" (chapter 4), "Collective or Mass Illusions and Hallucinations" (chapter 10), and "Witchcraft and Devil-Possession Epidemics" (chapter 15). Though some sections of the book show undue credulity (toward telepathy, for instance, perhaps partly because the discussion is over a century old), the book provides an interesting look at the topic from an earlier perspective. Transaction Publishers, 2016, 199 pp., $29.95.



THE HANDBOOK OF ATTENTION. Edited by Jonathan Fawcett, Evan Risko, and Alan Kingstone. Laboratory research on human attention has often been conducted under conditions that bear little resemblance to the complexity of our everyday lives. Although this research has yielded interesting discoveries, few scholars have truly connected these findings to natural experiences. This book bridges the gap between laboratory and life by bringing together cutting-edge research using traditional methodologies with research that focuses on attention in everyday contexts. Attention, of course, lies at the heart of eyewitness perception and reliability and is therefore an important factor in understanding the psychology of anomalous experiences and skeptical investigation. Heavily referenced, much of the book is technical and aimed at cognitive psychologists. Several chapters are of special interest to skeptics, including those on everyday visual attention, eyewitness memory, attention and misdirection, and the link between stress and attention. All chapters present their topics in the same overall format: historical context, current research, the possible integration of laboratory and real-world approaches, future directions, and key and outstanding issues. The MIT Press, 2015, 696 pp., $65.

—Benjamin Radford

The book is just what you might expect from a highly intelligent believer who was raised as a Christian and trained to argue as a philosopher. It is a tour de force of imagination and rationalization. His experiences require no supernatural explanations; we know enough about neurology and psychology to have at least a general understanding of how a person can hallucinate, deceive himself, and succumb to an elaborate delusion. There is no reason to attribute to God the words that could very well have come from Martin's own brain.

Hallucinations are not necessarily a sign of mental illness; Oliver Sacks wrote a whole book about that. Hallucinations can be very convincing and very powerful. They have led people to commit crimes and even kill their own children.

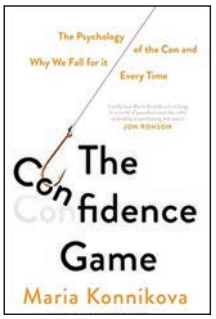
How could anyone ever know for sure that they were hearing a true message from God rather than a hallucination produced by their own brain? I don't think the individual has any reliable way to tell. But others can use critical thinking skills to reject stories such as Martin's for lack of evidence. The human brain is inexhaustibly inventive, and there have always been people able to fool themselves into believing six impossible things before breakfast just like Lewis Carroll's White Queen in *Through the Looking Glass*.

Hallucination or divine revelation? I think hallucination is much more likely. And I don't think there is any evidence that would prove me wrong. ■

Harriet Hall, MD, a retired physician and Air Force flight surgeon, writes and educates about pseudoscientific and so-called alternative medicine. She is a fellow and member of the Executive Council of the Committee for Skeptical Inquiry, a SKEPTICAL INQUIRER contributing editor, and an editor of the blog *Science-Based Medicine*.

The Art and Science of the Scam: Implications for Skeptics

SCOTT O. LILIENFELD



The Confidence Game: Why We Fall for It . . . Every Time. By Maria Konnikova. New York: Viking, 2016. ISBN: 978-0525427414. 352 pp. Hardcover, $28.

We're all suckers. Well, to be more precise, we're all suckers at least some of the time. Research conducted in 1996 by social psychologist Bella DePaulo, then at the University of Virginia, demonstrates that deception is part-and-parcel of everyday life. She asked participants to keep a diary of their fibs and discovered that most people lie about twice a day; they lie in about one-fifth of brief interpersonal interactions (of course, one might be tempted to ask whether some of them were lying about their lying, but that's another matter). No wonder the English language contains an estimated 112 words referring to lies or variants thereof: bluff, deceit, deception, exaggeration, fable, fib, fiction, jive, mendacity, misrepresentation, prevarication, spin, untruth, whopper, and so on.

We lie, and lie frequently, for two prime reasons. First, we lie because we have something to hide, something to gain, or someone to impress. Second, we believe that we can get away with it. This belief is usually justified. Classic laboratory research by University of California, San Francisco, psychologist Paul Ekman indicates that most of us don't perform much better than chance at detecting falsehoods, even though we're sure we do. Other research shows that we are often sorely mistaken about potential cues to lying. For example, surveys of laypersons suggest that most people regard shifty eyes as a bellwether of dishonesty, even though research indicates that this cue is well-nigh useless as a deception indicator (psychopaths, for example, tend to stare their victims straight in the eyes while duping them). As a consequence, pathological liars can run roughshod over the rest of us. Of course, most lies are innocuous, as when we tell our friend that we adore his hideously ugly new haircut. But some lies can lead us to fall prey to dangerous fads, even blatant pseudoscience.

In her engaging and eminently readable new book, *The Confidence Game: Why We Fall for It Every Time*, *New Yorker* magazine science journalist Maria Konnikova explores the science underlying one particularly malignant species of lie: the con. As she reminds us, the term *con* is short for *confidence*, and probably originated in 1849 during the New York City trial of William Thompson, who became the prototype of the con artist in film and literature (Herman Melville apparently modeled the central character in his 1857 novel

The Confidence-Man after Thompson). The charming Thompson would routinely approach passersby in Manhattan and unnerve them with a request: "Have you confidence in me to trust me with your watch (or ten dollars, or whatever) until tomorrow?" Many strangers, taken aback by Thompson's earnestness and prepossessing nature, would part ways with their possessions, only never to see them—or Thompson—again.

Konnikova's book should be of interest to readers of the Skeptical Inquirer for one key reason: gullibility can be dangerous, even disastrous. In several chapters, Konnikova describes the brazen exploits of fortune-tellers and other psychics who capitalize on the good will of vulnerable victims to deprive them of their hopes and resources. In Chapter 2 ("The Put-Up"), she tells the tale of Debra Saalfield, a professional dancer and dance instructor who sought out a psychic, Sylvia Mitchell, in Greenwich Village after losing her job and boyfriend in a matter of two days. Desperate to understand what befell her and why, Saalfield underwent a palm-reading, costing her $1,000. Soon after, Mitchell persuaded Saalfield that she had been a beautiful and rich Egyptian princess in a previous life, accounting for her excessive materialism in her present life. To conquer her undue attachment to money, Mitchell informed her, Saalfield would need to deposit $27,000 into Mitchell's bank account. She could of course have the money back whenever she wanted, but it would be a good psychological exercise nonetheless. In a moment of weakness, Saalfield went along with the scheme, even though she could barely afford it. When she returned to New York City to reclaim her money, Mitchell was nowhere to be found, and her repeated calls to Mitchell went unanswered.

Elsewhere, Konnikova offers a brief history of mysticism and efforts to debunk it, introducing us to Harry Houdini's skeptical exploits and James Randi's famous psychic financial challenge. In many respects, her book is a manifesto for skepticism in everyday life and a cautionary tale regarding the perils of excessive trust. It is also something of a "how to" instructional manual on how to fool others—and how to avoid being fooled.

In other chapters, Konnikova takes us on a tour of the techniques of con artists, linking their tricks of the trade to well-established psychological tools of persuasion. Among other methods, she describes the well-known "foot-in-the door" technique, whereby we are more likely to agree to a large request after agreeing to a small one, and the "mere exposure effect," whereby we prefer stimuli that we've experienced many times to those that are novel. She also recounts a variety of well-established pitfalls in thinking, such as confirmation bias (the tendency to seek out information that supports our beliefs and to ignore or distort the information that doesn't) and positivity bias (the tendency to assume that our futures will turn out well), that predispose most or all of us to fall prey to scams from time to time. Needless to say, both biases—and a host of others discussed in the book—can lead people desperate for simple answers to complex life problems to embrace astrologers, fortune-tellers, and other peddlers of the paranormal.

Each chapter follows a similar template. It begins with a remarkable and often disconcerting case of a real-world swindle and then uses the case to illustrate distinct components of the con. Although the narrative eventually becomes slightly repetitive (toward the end of the book, I had a difficult time keeping all the villains straight, because their *modus operandi* all bore a strong family resemblance), it lends the book a powerful coherence. The result is a vivid portrait of how con artists ply their trade.

At the same time, the book is marked by a few noteworthy omissions. First, in her discussion of psychics in particular, Konnikova focuses almost exclusively on scam artists. To be sure, the world is chock full of blatantly dishonest fortune-tellers, crystal ball readers, and tarot card readers. Yet Konnikova accords short shrift to the possibility that many purveyors of the paranormal are sincerely self-deceived. The Peter Popoffs of the world may be a distinct minority. Behaviorists have long recognized that a great deal of our psychological repertoire is acquired by means of progressive "shaping" of behaviors using repeated reinforcement. Many psychics have surely learned that their tried-and-true techniques of cold reading "work" in that they persuade customers that they have remarkable capacities of insight and precognition. After a while, the psychics themselves may become convinced too. An intriguing hypothesis that has yet to be adequately explored is that self-deceived psychics may actually be more persuasive than outright charlatans, because they are genuinely convinced of their extrasensory powers.

Behaviorists have long recognized that a great deal of our psychological repertoire is acquired by means of progressive "shaping" of behaviors using repeated reinforcement.

Second, Konnikova's focus is overwhelmingly on the psychology of the victims, rather than the perpetrators, of swindles. In an early chapter, she touches briefly on the scientific literature concerning psychopathic personality (psychopathy), a condition marked by extreme dishonesty and shallowness of conscience. Nevertheless, her coverage is rather superficial and, like many

authors, she treats psychopathy as a largely monolithic condition. As a consequence, she misses the opportunity to discuss recent research suggesting that psychopathy, rather than being a uniform entity, is a paradoxical configuration of diverse attributes comprising superficial charm, poise, and affability on the one hand and guiltlessness, callousness, and poor impulse control on the other. The psychopath is thus a hybrid creature, appealing on the outside yet malevolent on the inside. This deceptive cocktail of traits is precisely what makes the prototypical psychopath such an effective con artist. He or she is the human equivalent of the Venus flytrap.

There are also a few major slip-ups with respect to the history of psychological thinking. Konnikova describes Willhelm Wundt as "one of the founders of the Gestalt movement" in psychology when in fact Wundt was a structuralist, not a Gestaltist. (If anything, the Gestalt movement originated in response to Wundt's emphasis on decomposing human experience into basic elements.) In addition, she contends that early behaviorists, such as John B. Watson and B.F. Skinner, maintained that behavior "could largely be accounted for by almost purely cognitive reactions to discrete, identifiable environmental stimuli." This could hardly be further from the truth. Watson disowned thinking entirely and Skinner, while not denying the existence of cognitive reactions, viewed them as nothing more than covert behaviors.

These criticisms aside, *The Confidence Game* is a great read. It is an eye-opening and fascinating glimpse into a dark underworld that most of us only dimly grasp. Skeptics will appreciate the book's penetrating analysis of the psychology of the trickster and of the hazards of maladaptive gullibility. And I'm not pulling one over on you—really. Trust me. ■

Scott O. Lilienfeld is professor of psychology at Emory University in Atlanta and coauthor of *Brainwashed* and *50 Great Myths of Popular Psychology*. He is a fellow of the Association for Psychological Science and a fellow and member of the Executive Council of the Committee for Skeptical Inquiry.

[LETTERS TO THE EDITOR

Polygraphs as Junk Science

Dr. Morton Tavel has done the scientific community a great service with his highly readable review of polygraph junk science (January/February 2016). I'd like to add three observations.

First, neither law enforcement nor national security agencies have shared even their very old data that might provide some insight into the actual utility of the polygraph. After millions of tests in both criminal and employment-screening settings, there surely is enough information to inform on the polygraph's sensitivity and specificity. Taxpayers have shelled out billions of dollars to pay for polygraph tests, and researchers ought to have access to that data. Perhaps it is easy to surmise why these agencies haven't released any of it.

Second, fine civil servants lose their security clearances and thus their careers every year to the vagaries of "the box." I get several calls a year from high-ranking federal government employees who have failed their polygraphs and are looking to redress the horrific personal impacts (let alone the waste in discarding of experienced individuals). I know of no case where a security clearance was restored once lost to the stochastic judgment of polygraphers.

Finally, it is striking that even at the DOE national laboratories scientific evidence impacted the behavior of senior administrators not at all. When I aided a fellow scientist threatened with unemployment after a failed polygraph, my supervisor (obviously at the behest of the then-Sandia president) forced me out of my job. My father taught me that you can't reason someone out of a position they haven't been reasoned into in the first place. In the case of Sandia's manager-scientists, they manifested no reason a priori. Only the political interventions of then-Senators Domenici and Bingaman led to a dramatic reduction in polygraph testing.

Alan P. Zelicoff, MD
Professor of Environmental and Occupational Health and Epidemiology, Institute for Biosecurity
College for Public Health and Social Justice
St. Louis University
St. Louis, Missouri

The Science of Meaning

Tsipursky asks in "The Science of Meaning" (January/February 2016), can one create a personal and rich sense of purpose in life without belonging to a faith-based community? For me, the most profound answer to the questions "What is the meaning of life? Why are we here?" did indeed come from a faith-based community, but not of the kind you'd expect!

Matthew Inman, creator of the Internet comic series "The Oatmeal," wrote a semi-autobiographical book *The Terrible and Wonderful Reasons Why I Run Long Distances*. In one panel of cartoons, Inman recounts a training run in the bamboo forests of Japan, where he is hunted by deadly giant hornets, dehydrated from running without water (eventually quenched with a vending machine purple sports drink), and driven to hypothermia by a sudden weather change from hot and humid to dark with violent lightening. During this run, Inman finds *the* answer to the questions "Why am I alive? Why am I here? What's the point of me?":

"Forget the why. You are in a raging forest full of beauty and agony and magical grapey beverages and lightning storms and demon bees. This is better than the why."

Welcome to the Church of the Ultramarathon!

Paul Drumheller
Flagstaff, Arizona

I found Gleb Tsipursky's article on the importance of finding "meaning and purpose" in life lacking in insight. I regard attaining meaning and purpose solely as a means to an end based on reason, tolerance, and compassion, and not, as Tsipursky implies, as an end in itself. There are all too many examples of people throughout history who

have found meaning and purpose through abhorrent theocratic and secular ideologies. Think of the exultant homicidal members of the Khmer Rouge, ISIS, and Boko Haram, the populations who cheerfully embraced National Socialism and Fascism, and the clerics of the Inquisition, to cite just a few examples. Should we envy them for having found "meaning and purpose"? In a world being ravaged by war, climate change, superstition, and overpopulation, we need people whose meaning and purpose in life consists of recognizing, confronting, and solving these critical issues.

Dennis Middlebrooks
Brooklyn, New York

Gleb Tsipursky responds:

I agree with Dennis Middlebrooks that it would be wonderful if people found their meaning and purpose in dealing with war, climate change, superstition, and overpopulation. However, this article simply looked at the science of meaning and purpose and conveyed what the science suggested. While we may wish for science to provide us with the kind of answer we desire, this is not what the research suggests. When we talk about science, we need to be vigilant about sticking only to the answers provided by the science.

Scientific Knowledge

Charles S. Reichardt wrote an informative and pertinent scientific article "Trends in Scientific Knowledge, Education, and Religion," in the January/February 2016 issue.

I have been an ER doctor for thiry-five years, and I'm no astronomer; Dr. Reichardt says, "Educational attainment in America has increased ... knowledge of many standard scientific facts has not."

Truthfully yet ironically, he then goes on to expose our more scientifically ignorant Americans as "unaware of the fundamental Copernican reality that the Earth rotates around the sun . . . etc."

I and many others know that the Earth revolves around the Sun, not rotates. The Earth rotates on its axis.

Perhaps this can be forgiven of a psychologist, but I would hope that this fundamental error would be discovered and remedied prior to publication. That would be best for your journal's credibility, and our cause.

Steve Mimnaugh
mims_84093@yahoo.com

Charles Reichardt replies:

The common-place, dictionary definition of "rotate" fits perfectly well, it seems to me (with "revolve" listed as a synonym), although I believe the letter writer is correct that "revolve" is the more common usage among astronomers. It certainly would have been wiser of me to have used "revolve," but I'm not sure "rotate" counts as a literal error.

Whatever one might think about the state of scientific knowledge among our general population, the state of religious literacy is much worse. After all, children have had up to twelve years of science lessons using textbooks approved by some panel of science readers. Churches have energetically refused to teach any historical-critical information about the scriptures or church history, and have often blocked such teaching from taking place in our public schools.

I propose that in giving survey exams at the level of the following would result in massive numbers of wrong choices:

Jesus was a: (a) Christian, (b) Pharisee, (c) Jew, (d) Ebionite

Islam is divided into two main socio-cultural groups, the Sunni and the: (a) Sufi, (b) Alevi, (c) Druze, (d) Shia.

Sharon Scholl
Atlantic Beach, Florida

Negative Evidence

Just a quibble about Joe Nickell and James McGaha's excellent article "The Search for Negative Evidence" (November/December 2015): Although the use of negative evidence is disparaged throughout the article, there is little mention of what positive evidence might look like. It is not until the first paragraph of the conclusion that it is implied that an "actual flying saucer or extraterrestrial pilot" would constitute positive evidence of extraterrestrial beings having visited Earth. But would it? You would still need to somehow show that the object did in fact have extraterrestrial origins. Since the characteristics of extraterrestrial spaceships are unknown, you cannot test the object against any known properties. The only procedure we can use in trying to determine the likely origin of the object would be to test it against hypotheses of all known terrestrial origins. It's only negative evidence, but it's the only type of evidence at our disposal when we try to validate a hitherto unknown phenomenon.

The criticism against supporters of UFOs and other such "unexplained" phenomena should not be that they tend to use negative evidence to try to prove their existence. It's that the quality of that evidence is so poor. When you rely on unsubstantiated and conflicting accounts, it's relatively easy to dismiss all known rational explanations for a particular phenomenon and conclude that it's unexplainable and therefore of unearthly origin. The conclusion that is based on such evidence is extremely weak to the point of being entirely dismissible. But it's not simply because negative evidence was used—it's because it was *bad* negative evidence.

Tom Gasbarro
Brooklyn, New York

Joe Nickell and James McGaha respond:

We thank Tom Gasbarro for his compliment even though he goes on to suggest our entire concern was misplaced.

We did not wish only to discuss evidence that is "bad" (a smudged fingerprint for instance) but to provide much-needed insight into how paranormal claimants operate. We insisted on pointing out the qualitative differences between the scientific approach and paranormalists' reliance on "evidence" that is essentially nonexistent, non-verifiable, non-testable, and non-admissible. Not only that, but it is used to promote the paranormal by suggesting (in a mystery-mongering way) that because something is unexplained it must therefore be paranormal (the illogic of an "argument from ignorance").

We wisely avoided the snare of trying to say what positive evidence would look like, since paranormal claims are widely diverse, variously defined, and rife with imagination and even fantasy. We note that Mr. Gasbarro, more sympathetic to the plight of paranormalists than we, also has difficulty trying to offer a simple guide to authenticating unknowns.

We are confident that if, for example, an alien spacecraft or bigfoot carcass actually presents itself for examination, scientists will be able to verify its authenticity. (Some miracle claims, alleged spontaneous human combustion cases, and others are more problematic.) Meanwhile, proponents not only have "bad" evidence, but they attempt to make negative evidence seem positive, and they attempt to switch the burden of proof. We wanted to expose this pseudoscientific approach for what it is.

[FEEDBACK

The letters column is a forum on matters raised in previous issues. **Letters should be no longer than 225 words**. Due to the volume of letters we receive, not all can be published. Send letters as email text (not attachments) to letters@csicop.org. In the subject line, provide your surname and informative identification, e.g.: "Smith Letter on Jones evolution article." Include your name and address at the end of the letter. You may also mail your letter to the editor to 944 Deer Dr. NE, Albuquerque, NM 87122.

SKEPTICAL ANNIVERSARIES

by Tim Farley

May 1, 1776: A secret society called "The Illuminati" is founded in Bavaria. It has become a staple element of various conspiracy theories.

May 3, 1926: The 1926 Pulitzer Prize for Public Service is awarded to the *Columbus* (Georgia) *Enquirer-Sun* for (among other things) its opposition to the enactment of a law that would ban the teaching of evolution.

May 13, 1956: In *Parade* magazine, American psychic Jeane Dixon predicts a tall, young, blue-eyed Democrat will be elected president in 1960 and die in office. She would often later cite this as a correct prediction of the JFK assassination—ignoring her many other errors.

May 14, 1796: Edward Jenner invents the first vaccine by injecting a boy with cowpox, resulting in his immunity to smallpox. The disease would later be eradicated via vaccine.

May 18, 1996: *The New York Times* gives front-page coverage to Alan Sokal's hoax paper published in the journal *Social Text*. The controversy over the "Sokal Hoax" grows as a result.

May 18, 1926: Harry Houdini testifies before Congress concerning an anti–fortune-telling bill. The hearing ends when an argument erupts between Houdini and attending mediums.

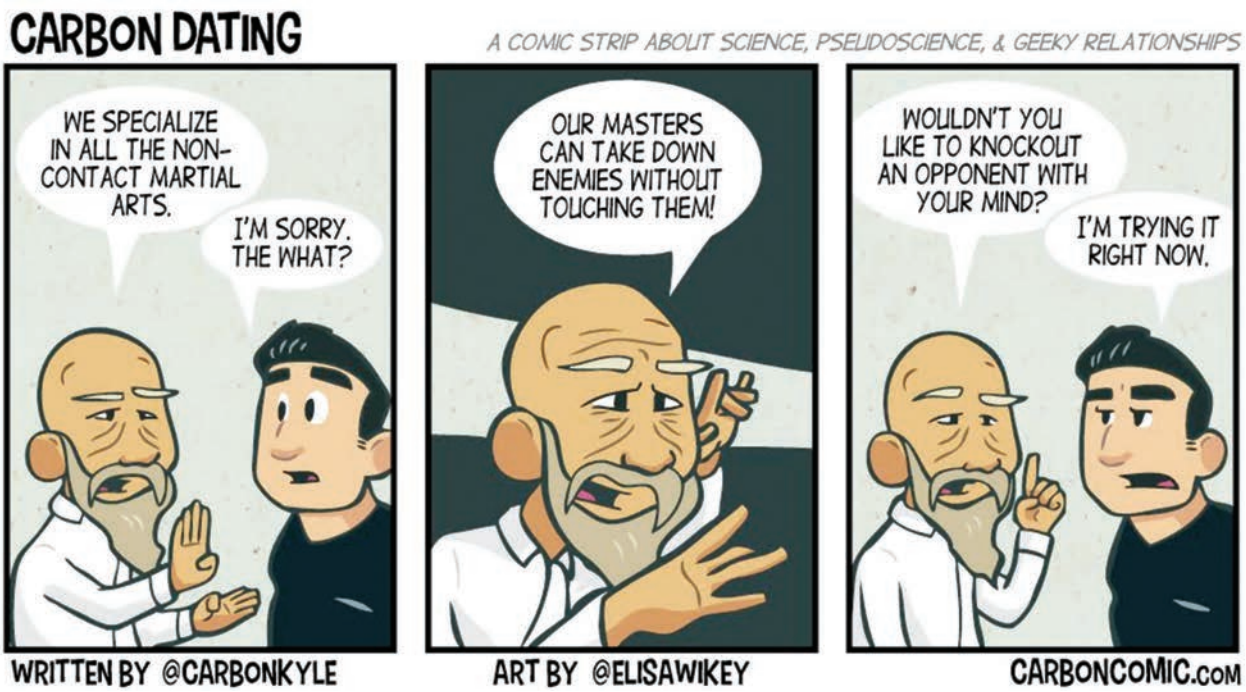
May 29, 1976: *Science News* covers the founding of CSICOP on its cover, provoking "more letters to the editor than about any previous *Science News* article in memory."

June 28, 2011: The United Nations declares the animal disease Rinderpest eradicated—the second disease eradicated via vaccines.

June 30, 1906: The U.S. Pure Food and Drug Act becomes law, making patent medicines illegal.

June 30, 1981: Sandra Mansi's photo of the alleged Lake Champlain monster "Champ" is published in the *New York Times*, increasing media attention to it.

Tim Farley is the creator of the website whatstheharm.net and blogs at skeptools.com. He is a past fellow of the James Randi Educational Foundation.


CARBON DATING
A COMIC STRIP ABOUT SCIENCE, PSEUDOSCIENCE, & GEEKY RELATIONSHIPS
WE SPECIALIZE IN ALL THE NON-CONTACT MARTIAL ARTS.
I'M SORRY. THE WHAT?
OUR MASTERS CAN TAKE DOWN ENEMIES WITHOUT TOUCHING THEM!
WOULDN'T YOU LIKE TO KNOCKOUT AN OPPONENT WITH YOUR MIND?
I'M TRYING IT RIGHT NOW.
WRITTEN BY @CARBONKYLE
ART BY @ELISAWIKEY
CARBONCOMIC.COM

Committee for Skeptical Inquiry

Scientific and Technical Consultants

Gary Bauslaugh,
writer and editor,
Victoria, B.C., Canada

Richard E. Berendzen,
astronomer, Washington, DC

Martin Bridgstock,
senior lecturer, School of Science,
Griffith Univ., Brisbane, Australia

Richard Busch,
magician/mentalist, Pittsburgh, PA

Shawn Carlson,
Society for Amateur Scientists,
East Greenwich, RI

Roger B. Culver,
prof. of astronomy, Colorado State Univ.

Felix Ares de Blas,
prof. of computer science,
Univ. of Basque, San Sebastian, Spain

Nahum J. Duker,
assistant prof. of pathology,
Temple Univ.

Taner Edis,
Division of Science/Physics
Truman State Univ.

Barbara Eisenstadt,
psychologist, educator, clinician,
East Greenbush, NY

William Evans,
prof. of communication,
Center for Creative Media

Bryan Farha,
prof. of behavioral studies in
education, Oklahoma City Univ.

John F. Fischer,
forensic analyst, Orlando, FL

Eileen Gambrill,
prof. of social welfare,
Univ. of California at Berkeley

Luis Alfonso Gámez,
science journalist, Bilbao, Spain

Sylvio Garattini,
director, Mario Negri Pharmacology
Institute, Milan, Italy

Susan Gerbic,
founder and leader of the Guerilla Skepticism on Wikipedia (GSoW) project

Laurie Godfrey,
anthropologist, Univ. of Massachusetts

Gerald Goldin,
mathematician, Rutgers Univ., NJ

Donald Goldsmith,
astronomer; president, Interstellar Media

Alan Hale,
astronomer, Southwest Institute for Space
Research, Alamogordo, NM

Clyde F. Herreid,
prof. of biology, SUNY Buffalo

Sharon Hill,
geologist, writer, researcher, creator and
editor of the *Doubtful News* blog

Gabor Hrasko,
chairman of the European Council of Skeptical Organizations (ECSO), president
of Hungarian Skeptics

Michael Hutchinson,
author; Skeptical Inquirer
representative, Europe

Philip A. Ianna,
assoc. prof. of astronomy,
Univ. of Virginia

I.W. Kelly,
prof. of psychology, Univ. of Saskatchewan,
Canada

Richard H. Lange,
MD, Mohawk Valley Physician
Health Plan, Schenectady, NY

William M. London,
California State Univ., Los Angeles

Rebecca Long,
nuclear engineer, president of Georgia
Council Against Health Fraud, Atlanta, GA

John R. Mashey,
computer scientist/executive (Bell Labs, then
Silicon Valley), analyst of climate-change
denial, contributor to *DeSmogBlog* and
Skeptical Science,
Portola Valley, CA

Thomas R. McDonough,
astrophysicist, Pasadena, CA

James E. McGaha,
astronomer, USAF pilot (ret.)

Joel A. Moskowitz,
director of medical psychiatry, Calabasas
Mental Health Services, Los Angeles

Matthew C. Nisbet,
associate professor of communication
studies, public policy, and urban affairs at
Northeastern University

Julia Offe,
neurobiologist, science journalist, creator
of German Science Slam

John W. Patterson,
prof. of materials science and
engineering, Iowa State Univ.

James R. Pomerantz,
prof. of psychology, Rice Univ.

Gary P. Posner,
MD, Tampa, FL

Tim Printy,
amateur astronomer, UFO skeptic, former
Navy nuclear reactor operator/division chief,
Manchester, NH

Daisie Radner,
prof. of philosophy, SUNY Buffalo

Robert H. Romer,
prof. of physics, Amherst College

Karl Sabbagh,
journalist, Richmond, Surrey, England

Robert J. Samp,
assistant prof. of education and
medicine, Univ. of Wisconsin-Madison

Steven D. Schafersman,
asst. prof. of geology, Miami Univ., OH

Chris Scott,
statistician, London, England

Stuart D. Scott Jr.,
associate prof. of anthropology,
SUNY Buffalo

Erwin M. Segal,
prof. of psychology, SUNY Buffalo

Carla Selby,
anthropologist / archaeologist

Steven N. Shore,
prof. of astrophysics, Univ. of Pisa, Italy

Waclaw Szybalski,
professor, McArdle Laboratory, Univ.
of Wisconsin–Madison

Sarah G. Thomason,
prof. of linguistics, Univ. of Pittsburgh, PA

Tim Trachet,
journalist and science writer, honorary
chairman of SKEPP, Belgium

David Willey,
physics instructor, Univ. of Pittsburgh, PA

Affiliated Organizations | United States

ALABAMA
Alabama Skeptics, Alabama. Emory Kimbrough. Tel.: 205-759-2624. 3550 Watermelon Road, Apt. 28A, Northport, AL 35476

ARIZONA
Tucson Skeptics Inc. Tucson, AZ. James McGaha. Email:mcgaha@skepticus.com. 5100 N. Sabino Foothills Dr., Tucson, AZ 85715

Phoenix Area Skeptics Society (PASS) http://phoenixskeptics.org Email: phoenixskeptics@gmail.com

Phoenix Skeptics, Phoenix, AZ. Michael Stackpole, P.O. Box 60333, Phoenix, AZ 85082

CALIFORNIA
Sacramento Organization for Rational Thinking (SORT) Sacramento, CA. Ray Spangenburg, co-founder. Tel.: 916-978-0321; Email: kitray2@comcast.net. PO Box 2215, Carmichael, CA 95609-2215 http://home.comcast.net/~kitray2/site/

Bay Area Skeptics (BAS) San Francisco–Bay Area. Eugenie C. Scott, President. 1218 Miluia St., Berkeley, CA 94709. Email: scott@ncse.com. www.BASkeptics.org

Independent Investigations Group (IIG), Center for Inquiry–Los Angeles, 4773 Hollywood Blvd, Los Angeles, CA 90027. Tel.: 323-666-9797. www.iighq.com

Sacramento Skeptics Society, Sacramento. Terry Sandbek, President. 4300 Auburn Blvd. Suite 206, Sacramento CA 95841. Tel.: 916 489-1774. Email: terry@sandbek.com

San Diego Association for Rational Inquiry (SDARI) President: Tom Pickett. Email: pickett.thomasj@gmail.com. Program/general information 619-421-5844. www.sdari.org. Postal address: PO Box 623, La Jolla, CA 92038-0623

CONNECTICUT
New England Skeptical Society (NESS) New England. Steven Novella M.D., President. Tel.: 203-281-6277; Email: board@theness.com. 64 Cobblestone Dr., Hamden, CT 06518 www.theness.com

D.C./MARYLAND
National Capital Area Skeptics NCAS, Maryland, D.C., Virginia. D.W. "Chip" Denman. Tel.: (240) 670-6227. Email: ncas@ncas.org. PO Box 8461, Silver Spring, MD 20907-8428 http://www.ncas.org

FLORIDA
Tampa Bay Skeptics (TBS) Tampa Bay, Florida. Rick O'Keefe, contact person. Tel.: 813-505-7013; Email: tbs@centerforinquiry.net. c/o O'Keefe, 4011 S. Manhattan Ave. #139, Tampa, FL 33611-1277. www.tampabayskeptics.org

ILLINOIS
Rational Examination Association of Lincoln Land (REALL) Illinois. Bob Ladendorf, Chairman. Tel.: 217-546-3475; Email: chairman@reall.org. PO Box 20302, Springfield, IL 62708 www.reall.org

Chicago Skeptics Jennifer Newport, contact person. Email: chicagoskeptics@gmail.com. www.chicagoskeptics.com

LOUISIANA
Baton Rouge Proponents of Rational Inquiry and Scientific Methods (BR-PRISM) Louisiana. Marge Schroth. Tel.: 225-766-4747. 425 Carriage Way, Baton Rouge, LA 70808

MICHIGAN
Great Lakes Skeptics (GLS) SE Michigan. Lorna J. Simmons, Contact person. Tel.: 734-525-5731; Email: Skeptic31@aol.com. 31710 Cowan Road, Apt. 103, Westland, MI 48185-2366

Tri-Cities Skeptics, Michigan. Dr. Gary Peterson. Tel.: 989-964-4491; e-mail: peterson@svsu.edu. www.tcskeptics.blogspot.com

MINNESOTA
St. Kloud Extraordinary Claim Psychic Teaching Investigating Community (SKEPTIC) St. Cloud, Minnesota. Jerry Mertens. Tel.: 320-255-2138; Email: gmertens@stcloudstate.edu. Jerry Mertens, Psychology Department, 720 4th Ave. S, St. Cloud State Univ., St. Cloud, MN 56301

MISSOURI
Skeptical Society of St. Louis (SSSL) St. Louis, Missouri. Michael Blanford, President. Email: info@skepticalstl.org. 2729 Ann Ave., St. Louis, MO 63104 www.skepticalstl.org

St. Joseph Skeptics
P.O. Box 8908
St. Joseph MO, 64508-8908

NEVADA
Reno Skeptical Society, Inc., Brad Lutts, President. Tel.: (775) 335-5505; Email: info@RenoSkeptics.org. 18124 Wedge Parkway #1052 Reno, Nevada 89511. www.RenoSkeptics.org

NEW MEXICO
New Mexicans for Science and Reason (NMSR) New Mexico. David E. Thomas, President. Tel.: 505-869-9250; Email: nmsrdave@swcp.com. 801 Fitch Ave., Socorro, NM 87801. www.nmsr.org

NEW YORK
New York City Skeptics Michael Feldman, president. PO Box 5122 New York, NY 10185. www.nycskeptics.org

Central New York Skeptics (CNY Skeptics) Syracuse. Lisa Goodlin, President. Tel: (315) 636-6533; Email: info@cnyskeptics.org, cnyskeptics.org PO Box 417, Fayetteville, NY 13066

OHIO
Central Ohioans for Rational Inquiry (CORI) Central Ohio. Charlie Hazlett, President. Tel.: 614-878-2742; Email: charlie@hazlett.net. PO Box 282069, Columbus, OH 43228

Cleveland Skeptics Joshua Hunt, Co-Organizer, www.clevelandskeptics.org

South Shore Skeptics (SSS) Cleveland and counties. Jim Kutz. Tel.: 440 942-5543; Email: jimkutz@earthlink.net. PO Box 5083, Cleveland, OH 44101 www.southshoreskeptics.org

Association for Rational Thought (ART) Cincinnati. Roy Auerbach, president. Tel: (513)-731-2774, Email: raa@cinci.rr.com. PO Box 12896, Cincinnati, OH 45212. www.cincinnati skeptics.org

OREGON
Oregonians for Science and Reason (O4SR) Oregon. Jeanine DeNoma, president. Tel.: (541) 745-5026; Email: wilkinsa@peak.org; 39105 Military Rd., Monmouth, OR 97361. www.04SR.org

PENNSYLVANIA
Philadelphia Association for Critical Thinking (PhACT), Bob Glickman President. 653 Garden Road Glenside PA 19038. 215-885-2089 E-mail: President@phact.org. Website: www.phact.org

TENNESSEE
Rationalists of East Tennessee, East Tennessee. Carl Ledenbecker. Tel.: (865)-982-8687; Email: Aletall@aol.com. 2123 Stonybrook Rd., Louisville, TN 37777

TEXAS
North Texas Skeptics NTS Dallas/Ft Worth area, John Blanton, Secretary. Tel.: (972)-306-3187; Email: skeptic@ntskeptics.org. PO Box 111794, Carrollton, TX 75011-1794. www.ntskeptics.org

VIRGINIA
The James Randi Educational Foundation. James Randi, Director. 2941 Fairview Park Drive, Suite 105 Falls Church, VA 22042 Email: jref@randi.org Telephone: 571-318-6530

Science & Reason, Hampton Rds., Virginia. Lawrence Weinstein, Old Dominion Univ.-Physics Dept., Norfolk, VA 23529

WASHINGTON
Seattle Skeptics
www.seattleskeptics.com

The organizations listed above have aims similar to those of the Committee for Skeptical Inquiry but are independent and autonomous. Representatives of these organizations cannot speak on behalf of CSI. Please send updates to Barry Karr, P.O. Box 703, Amherst NY 14226-0703.
International affiliated organizations listed at www.csicop.org.

CENTERS FOR INQUIRY
www.centerforinquiry.net/about/branches

Transnational
3965 Rensch Road, Amherst, NY 14228
Tel.: (716) 636-4869

Austin
PO Box 202164, Austin, TX 78720-2164
Tel.: (512) 919-4115

Chicago
chicago@centerforinquiry.net

Indianapolis
350 Canal Walk, Suite A, Indianapolis, IN 46202
Tel.: (317) 423-0710

Los Angeles
4773 Hollywood Blvd., Hollywood, CA 90027
Tel.: (323) 666-9797

Michigan
3777 44th Street SE, Grand Rapids, MI 49512
Tel.: (616) 698-2342

New York City
33-29 28th St. Astoria, NY 11106

San Francisco
email: sf@centerforinquiry.net

Tampa Bay
4011 S. Manhattan Ave. #139, Tampa, FL 33611-1277
Tel.: (813) 505-7013

Washington, DC
1020 19th Street., NW, Suite 425
Washington, DC 20036
tel.: (202) 629-2403

Argentina
Buenos Aires, Argentina
alejandroborge@gmail.com
www.cfiargentina.org

Canada
55 Eglinton Ave. East, Suite 307
Toronto, Ontario, M4P 1G8, Canada

China
China Research Institute for Science Popularization, NO. 86, Xueyuan Nanlu Haidian Dist., Beijing, 100081 China
Tel.: +86-10-62170515

Egypt
44 Gol Gamal St., Agouza, Giza, Egypt

France
Dr. Henri Broch, Universite of Nice, Faculte des Sciences, Parc Valrose, 06108, Nice cedex 2, France Tel.: +33-492-07-63-12

Germany
Arheilger Weg 11, 64380 Rossdorf, Germany
Tel.: +49-6154-695023

India
46 Masi garh, New Friends Colony
New Delhi 110025
Tel.: 91-9868010950

London
Conway Hall, 25 Red Lion Square,
London WC1R 4RL, England

Nepal
Humanist Association of Nepal,
PO Box 5284, Kathmandu Nepal
Tel.: +977-1-4413-345

New Zealand
email: bcooke@centerforinquiry.net

Nigeria
PO Box 25269, Mapo, Ibadan, Oyo State, Nigeria
Tel.: +234-2-2313699

Peru
D. Casanova 430, Lima 14, Peru
email: cipsiperu@yahoo.com

Poland
Lokal Biurowy No. 8, 8 Sapiezynska Sr.,
00-215, Warsaw, Poland

Romania
Fundatia Centrul pentru Constiinta Critica
Tel.: (40)-(0)744-67-67-94
email: CenterforInquiry.Romania@gmail.com

Russia
Dr. Valerii A. Kuvakin, 119899 Russia, Moscow,
Vorobevy Gory, Moscow State Univ.,
Philosophy Department

Senegal
PO Box 15376, Dakar – Fann, Senegal
Tel.: +221-501-13-00